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THE
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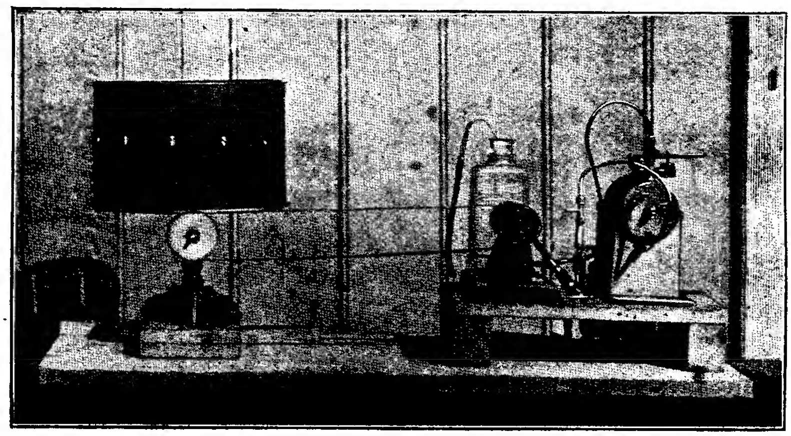
EDITED BY PERCIVAL MARSHALL, A.I.MECH.E.

VOL. IX. No. 128. OCTOBER 8, 1903. PUBLISHED WEEKLY.

A Steam-driven Zoetrope.

By M.D.



A STEAM-DRIVEN ZOETROPE.

THIS installation presents several points of interest in so far as the engine is a very small one, doing something useful which could not be done nearly so well by hand, and that having a force-pump it can work so long as the fire is kept going with practically no attention.

The boiler, a horizontal brass one, 4 ins. long and 2½ ins. in diameter, is over twenty years old, and has driven several engines before the present one. The firebox, which serves as a stand, is a piece of an old brass door-plate, bent round the front and sides and open behind. The fittings consist of a manhole, weight lever safety-valve blowing off at 10 lbs., steam-tap to engine, two pet-cocks, and force-pump delivery tap.

The engine has two single-action cylinders, ½-in. bore, ¾-in. stroke with spring seats, which were originally part of a loco purchased in 1883. They now drive two heavy flywheels mounted on a pair of standard bearings. The old pistons have been done away with, and trunk pistons—a sliding fit, without any packing—have been substituted. This method shows a marked increase of efficiency.

On the shaft connecting the flywheels is an eccentric, which works the pump. This is ⅛ in. bore, and ¼ in. stroke, with a copper plunger a sliding fit in the barrel, and made pressure-tight with a gland packed with cotton wick. The valves are two Lucas bicycle tyre valves, and work very well indeed. On the water delivery is a test-cock, so that the pump may be started without difficulty even against full pressure of steam. This pump will put half an ounce of water per minute into the boiler at full speed, nearly twice the amount necessary for the consumption of the engine, without making the slightest difference to the power available; the

only point one notices is that even with a fierce fire the safety-valve never blows off.

The fire is a painter's blowlamp, burning ordinary petrol; it consumes a-quarter of a pint per hour at the cost of one penny. If burning too fiercely, a little cold water is put in the trough round the burner, and by this means any degree of fire can easily be maintained.

The zoetrope is 7 ins. in diameter, and runs on a central needle bearing; it is worked from one of the engine flywheels by a tape belt. This drives an intermediate wheel having two steps, one carrying the belt and the other just touching the periphery of the zoetrope. To get a good illumination an oil-lamp is supported in the middle of the zoetrope in a cigarette-tin, one half of which has been cut away; the other half acting as a reflector.

The best images are obtained when the zoetrope is running at 100 revolutions per minute, and this means an engine speed of 650.

There are twenty-four different series of images to be seen, and to run through these on a winter's evening, with the knowledge that there need be no anxiety about burning the boiler, forms quite an interesting entertainment.

A One-Man Electric Tramcar.

THE one-man tramcar, the trials of which have now been brought to a successful close, in use at Southport, will it is considered be found useful in the less busy times and seasons, when as we understand the large two-deck cars do not pay. To overcome this difficulty, and yet provide good accommodation and a frequent service for such passengers as there were, Mr. J. S. Raworth, the chairman of the Southport Tramways Company, designed the above-mentioned one-man car, which costs a great deal less in operation than the ordinary large car. The one-man car weighs about 4½ tons, and is capable of seating twenty passengers. It is fitted with hand and electric brakes, and a single official acts as driver and conductor both rolled into one. Passengers enter the car by the driver's platform and put their fares in a box. The rear step is folded up and locked by a gate. Between the part of the platform occupied by the driver and the entrance to the body of the car is a bar which, on being lifted to admit passengers, temporarily cuts off the current; or, in the event of the driver becoming incapacitated from any cause, and anyone going to his assistance, the lifting of the bar stops the car. The car cannot be started until the gate is closed. Very little force is required to operate the controller handle, and every position of the handle agrees with a certain speed of the car. The forward position gives full speed, and the backward position no speed. Therefore, to stop the car it is necessary only to pull back the handle.

NEW ATLANTIC RECORD.—The North German liner *Deutschland* has lowered the Atlantic record by 3 mins., having crossed in 5 days, 11 hrs. 54 secs. The vessel now holds both the eastern and the western records. The new record cuts 29 mins. off the previous western record, and gives an average speed of 23·15 knots. The best day gave a run of 583 miles.

The Society of Model Engineers.

[Reports of meetings should be sent to the offices of THE MODEL ENGINEER *without delay, and will be inserted in any particular issue if received a clear nine days before its actual date of publication.]*

London.

On Thursday, September 24th, the first indoor meeting of the Society for the winter Session was held, at the Holborn Town Hall, Gray's Inn Road, about 70 members being present, Mr. W. T. Bashford taking the chair.

The formal business consisted of the reading of the minutes, and announcements of future meetings, and an appeal for practical papers on model engineering subjects. The Conversazione will most likely be held in January next, and the Committee are considering the desirability of holding a Model-making Competition at the end of the season.

The chief feature of the evening was the model exhibits, which were numerous, and included a splendid partly finished model "Dunalastair" locomotive to ¾-in. scale, tools, and undertype casting lists by Mr. James Mackenzie; model G.W.R. "Atbara" locomotive to the same scale by W. T. Bashford; model locomotive boiler by H.C. Willis; a model railway wagon; a volt and ammeter mounted on a switchboard by Mr. H. G. Riddle; model 2-in. gauge N.L.R. locomotive by Messrs. Bassett-Lowke and Co., which was shown working on the Society's track. Mr. A. P. Whatley's ¾-in. scale tank engine, Mr. Bowling's locomotive, and the model locomotive "Ecclesbourne," described on another page, were also exhibited at work on the track. Mr. H. Hildersley brought a miniature model G.N.R. locomotive, which can be carried in the waistcoat pocket; and Mr. J. C. Taylor showed his partly finished model road roller. Altogether, the evening was a very successful one, and several new members were enrolled.

FUTURE MEETINGS.—The next meeting will be held on Thursday, October 15th, on which date a paper by Mr. J. E. Clogg and H. Hildersley will be read on the subject of "Silver soldering." On Thursday, November 12th, the Annual General Meeting will take place in the Committee Room, Holborn Town Hall, at 7 p.m. A good show of models is desired at each meeting, and readers who would like to join the Society are cordially invited. —HENRY GREENLY, Hon. Sec., 2, Upper Chadwell Street, Myddelton Square, London, E.C.

Provincial Societies.

TO READERS IN BUXTON.—It is desired that notice shall be given to readers of the *M.E.* of an effort to form a Local Society in Buxton and the neighbourhood. Mr. S. James, Fountain Street, Buxton, Derbyshire, will be glad to receive letters from model engineers who will support the scheme.

A BROWN bronze dip for coating small hardware articles is made of 1 lb. of iron scales, 1 lb. of arsenic, 1 lb. of muriatic (hydrochloric) acid, and 10 ozs. of solid zinc. The zinc should be kept in only when the bath is used. The castings must be perfectly free from sand and grease.

Workshop Notes and Notions.

[*Readers are invited to contribute short practical items for this column, based on their own workshop experience. Accepted contributions will be paid for on publication, if desired, according to merit. All matter intended for this column should be marked* " WORKSHOP " *on the envelope.*]

A Taper Turning Attachment for the Lathe.

By C. HAWKINS.

The accompanying sketches represent a handy and easily made appliance for providing lathes (which are not provided with an offset tailstock) with a taper turning arrangement. It is readily adjusted, and can be set to produce the required taper in a few minutes.

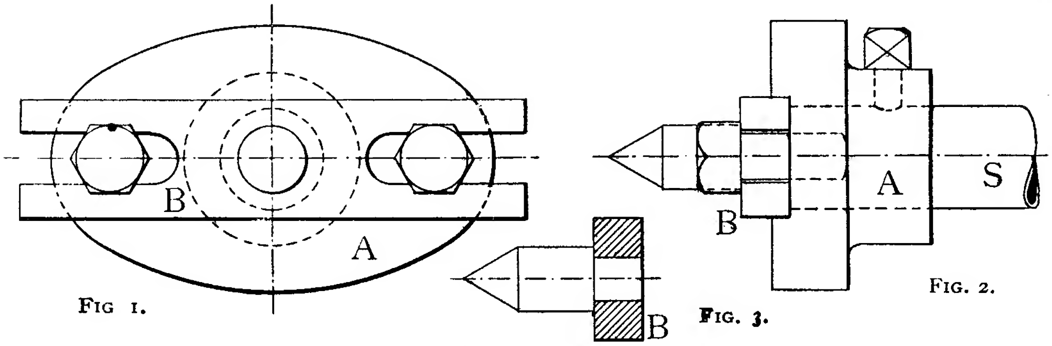


FIG 1. FIG. 3. FIG. 2.

AN ATTACHMENT FOR TAPER TURNING.

The casting A is made from a gland pattern, and is bored to fit the tailstock spindle S, and is fastened by a setscrew as shown. In the casting a groove is planed or filed about $\frac{1}{4}$ in. deep into which a forging B is made a sliding fit. It will be seen that this piece has slotted ends for adjustment, and is fastened in position by two setscrews. The steel centre is either screwed into B, or may be made a driving fit into B as shown (Fig. 3), the back to be filed flush.

Care should be taken to make the groove central, *i.e.*, half above and half below the line of centres, so that the new centre will be the proper height.

Metal Turning Notes.

By W. G. B.

When square-centreing steel forgings, &c., for turning, the sharp bits formed in and around the hole, which are rather awkward to remove by wiping, will fall off if the end of the work be dipped in "soda-water," the same as used for a turning lubricant. Also, the annoying jarring which often accompanies the turning of work of fairly large diameter, when a heavy cut is taken, can generally be abated by placing a pad of waste between the carrier and the driving pin.

A Hint to Users of Leclanche Batteries.

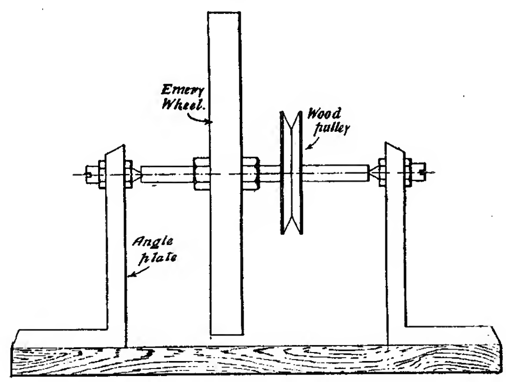
By G. W. MORTIMER.

There may be many, like myself, who are large users of Leclanché batteries. To keep on recharging the batteries is an expensive item for any with slender pockets, so this hint may not be wasted. I have used salt and rain-water for a considerable time now and find it quite as good as sal ammoniac. The best way to recharge them is as follows :—Measure out the quantity of rain-water that you require, and then dissolve as much salt as possible in it. Pour in the batteries, and then close the circuit for about a quarter-of-an-hour, afterwards leaving the cells for at least twelve hours, when they will be ready to use again. If the current is not *quite* sufficient it can be augmented by putting an extra zinc rod in one or two of the batteries. When the batteries begin to weaken, add a little more salt and give them a rest, when they will regain their former strength.

A Substitute for an Emery Wheel.

By H. G. T.

Emery wheels are an expensive item in the amateur's workshop; really effective substitutes may be made as follows :—Turn in the lathe wood wheels $\frac{3}{8}$ in. smaller in diameter than the emery wheel required, but full width. Cut a strip of $\frac{1}{8}$ in. leather the width of the wheel, which is then glued and the leather fastened on with wood pegs made of match sticks. When the glue is set, glass-paper the leather to give smooth surface, then glue the leather all round and dip in emery powder; when set, re-



A SUBSTITUTE FOR AN EMERY WHEEL.

peat. The sides of the wheel may be treated in a similar manner if so desired; the emery may be renewed at any time.

Bore a hole through centre of wheel, cut a thread on spindle, and fix wheel on with a nut each side; centre punch ends of spindle. The wheel may now be run between lathe centres by driver chuck, or two angle plates may be forged as in illustration, centre-points and a wooden pulley turned and fitted, and the wheel driven by a strap from the treadle-gear.

The Latest in Engineering.

Turbine Engines for Atlantic Liners.—The Cunard Steamship Company has, we understand, been consulting with some British and German shipbuilding and engineering firms with respect to the adoption of turbine engines on board the two new huge liners which the company are about to build. Apparently, a serious difficulty has arisen in reference to the adoption of ordinary engines, as the shafting necessary to ensure twenty-five knots hourly continuous steaming for six days would be enormous. Calculations that have been made indicate that turbines would give a saving in weight of nearly 3000 tons, besides reducing the engine-room staff. The Cunard Company, it is understood, has not yet arrived at a definite decision.

The New Westinghouse Railway Coupler.—Mr. George Westinghouse has invented a new coupler, which combines in itself and automatically performs the functions of all the various couplers, buffers, electrical cables, and hoses which must be joined between two electric cars. The new device, which is being shown by the Westinghouse Brake Company at their King's Cross works, is entirely controlled from a single handle. Turning this handle to one position sets the coupler ready to engage automatically with the similar coupler on another car as soon as the two come in contact. A slight further turn of the handle opens the air-brake cock, and the train is now completely connected up and ready to start. A single turn of the same handle serves to shut the cock of the air-brake, and then to disengage the couplers, leaving the cars free to separate.

Electrical Signalling on the N.E.R.—The North-Eastern Railway have recently installed at one of their most important junctions at York a system of electric power signalling similar to that in operation at the present time on the London and North-Western at Crewe. The system is to be brought into use on Sunday, the 20th September. It is being installed by the Railway Signalling Company, Ltd., of Fazakerley, Liverpool, and consists of the application of electric power to the operation of the signal points in substitution for manual mechanism. The installation at Severn's Junction is undertaken with a view to effect economy of labour in the signal cabin along with increased efficiency and expedition of working. No new principle is introduced into the method of signalling, but the operations will be conducted at an enormously accelerated speed, while the distinctly hard work of the signalman under the existing system will be eliminated. There are no less than sixty-three signals and fifty-one pairs of points connected with the cabin, and the lever frame is supplied with 133 levers. The latter are all of miniature size, thus enabling a much smaller cabin to be used than would be requisite under the old system for so great an amount of work. The most distant signal is three-quarters of a mile from the cabin, yet the whole of the operations can be conducted at a minimum of labour in working the levers. The signals will, as heretofore, be lighted by gas; at Crewe they are lighted by electricity, with the advantage to the operator that he can switch on all his lights without delay in the event of sudden darkness or fog.

Technical Instruction for Great Western Railway Apprentices.—In order to encourage apprentices to gain a sound knowledge of technical science, the Great Western Railway Company offer facilities in conjunction with the Swindon Education Committee, for a limited number of selected students to attend day classes at the Technical School. Candidates must be registered apprentices between 17 and 18 years of age. They must have spent at least one year in the factory, and must have regularly attended for at least one session in the preparatory group of evening classes at the Technical School. The number of studentships will be limited to thirty at any one time, in groups as follows, for a three years' course:—First year's course, fifteen students; second year's course, nine students; third year's course, six students. For each year's course there will be a competitive examination, successful students passing on from one year's course to the next. The course of study for each year will consist of practical mathematics, practical mechanics, geometrical and machine drawing, heat, electricity and chemistry. Those attending the classes will have their wages paid as if at work in the factory, and the Great Western Railway Company will pay their school fees. The students attending the day classes will be expected to give some time each evening to private study. They should devote themselves particularly to the prescribed course, so as to obtain a thorough knowledge of a few of the most important subjects rather than a smattering of a great number. Students who distinguish themselves will be allowed to spend part of their last year in the drawing office and chemical laboratory.

A New Turbine Channel Steamer.—The London Brighton, and South Coast Railway Company's new turbine steamer, *Brighton*, recently made her official trial trips. The times were 3 hours 3 mins. from Newhaven to Dieppe, a distance of 64 knots, and 3 hours 2 mins. from Dieppe to Newhaven. The sea was choppy, and the conditions not too favourable; but the vessel behaved splendidly with an exceptional absence of vibration. The new steamer carries over 1000 passengers, as compared with about 900 carried in the *Arundel*. The main engines in the *Brighton* consist of three separate turbines, each driving its own line of shafting—the centre turbine at high pressure, and the two side ones at low pressure. When going ahead in ordinary work the steam is admitted to the high-pressure turbine, and after expansion there passes to the low-pressure turbines, and then to the condensers, the total ratio of expansion being much greater than in triple-expansion reciprocating engines. In the ordinary steaming speed of the *Brighton* the revolutions of the centre shaft are about 500, and of the two side shafts 600 per minute. Steam is supplied to the turbines by four single-ended return tube boilers, constructed by Messrs. Denny & Co., the working pressure being 150 lbs. The dimensions of the new steamer are 282 ft. by 34 ft.; depth, 15 ft. 2½ ins. Her gross register is 1,130 tons. She is timed to cross the Channel to Dieppe in three hours three minutes.

The Motor Bicycle: Its Design, Construction and Use.

By T. H. Hawley.

(Continued from page 495, Vol. VIII.)

XIV.—The Piston, Connecting-rod, Valves, etc.

THE parts now required to complete the cylinder portion of the motor are—the piston, connecting-rod, the two valves with guides, springs, and keyplate, and the three valve-chamber

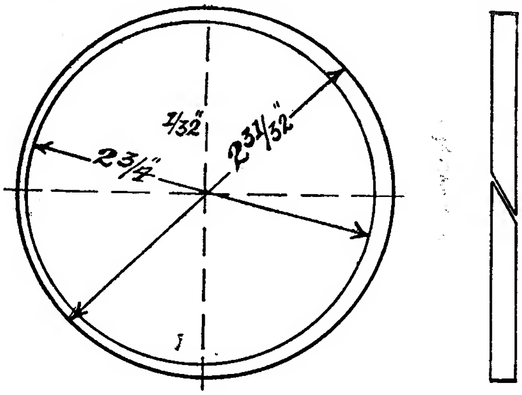


Fig. 63.

caps, or plugs. First in importance comes the piston and rings, and here there is room for the display of good workmanship, especially in the fitting of the rings to the piston grooves and to the cylinder, and again in getting the bore for the cross-head pin at a true right-angle.

Full details of the piston are given in the drawings, Figs. 64 and 65, and the piston-ring in Fig. 63.

The piston casting should be cored out to finished size, so that there is no internal turning to be done,

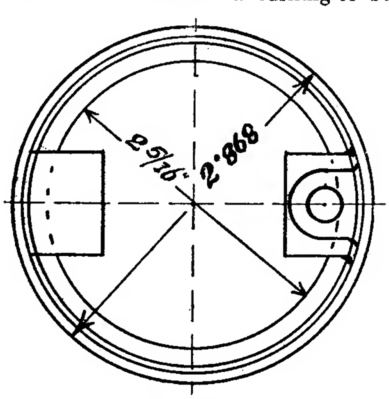


Fig. 64.

and on the solid top a lug is cast for chucking purposes, which is afterwards cut away with the hack-saw. The cross-pin lugs must be cast in proper position to bring the distance right from centre of cross-head pin to piston top, or the compression space will be altered.

It is advisable to finish the turning all at one chucking, which must be securely done to stand a broad-pointed tool clearing out the ring seatings, and in this connection it may be wise to overhaul the adjustment of lathe mandrel to prevent any lift, as this would cause the grooves to be turned of unequal width and depth. this fault being quite inadmissible, as it would then be impossible to get the piston quite gas-tight, which is a most important

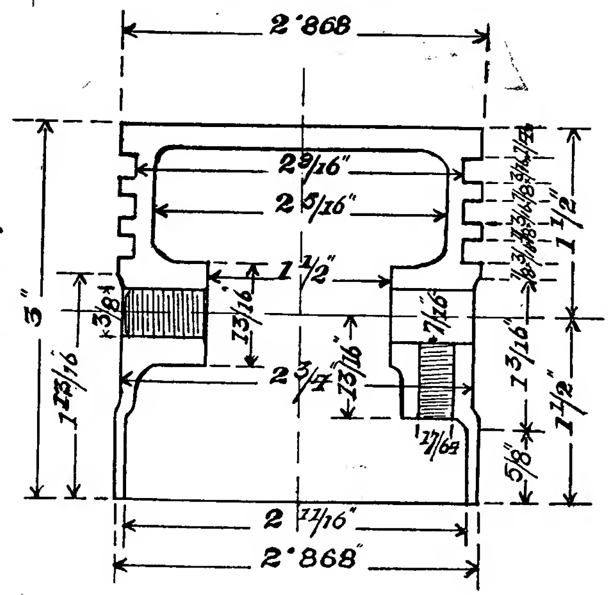


Fig. 65.

matter in all small gas engines, and especially so where a high degree of compression is aimed at.

It is also important that the sides of the grooves are parallel, or square, to the bottom, and that they are scraped perfectly smooth, so that our rings may be a ground-in fit. To this end I have found a tool cutting on each side only and ground perfectly flat on top, as for brass, to be best; the two cutting sides being first tested for parallelism and the tool somewhat narrower than the finished size of the groove, the finishing cuts being obtained by movement of the cross-slide handle, and the width of the grooves controlled by a gauge-plate filed out of a strip of sheet steel to the dimension shown on the drawing.

To some readers all this may appear quite elementary and unnecessary instruction on a plain and simple job; but there are others who would surely spoil the work unless such small matters were emphasised; and I must again repeat that to those who are accustomed only to steam practice, workmanship which might pass as fairly good would, in the case of the petrol motor, be distinctly poor.

Although rather away from the direct constructional process, I am induced by the above remark—and a remembrance of a few letters which have recently reached me from correspondents—to make a few remarks which may be of service to others who are as yet only in the pattern-making stage.

One correspondent sends me well-made, full-size tracings of this motor, and inquiries whether, at two or three points in the design, there is not too

much metal? Well, I have previously enlarged on the importance of keeping the walls of an air-cooled motor as thin as possible consistent with strength, and also shown that an air-cooled motor is limited in size and power by the over-heating effects, as,

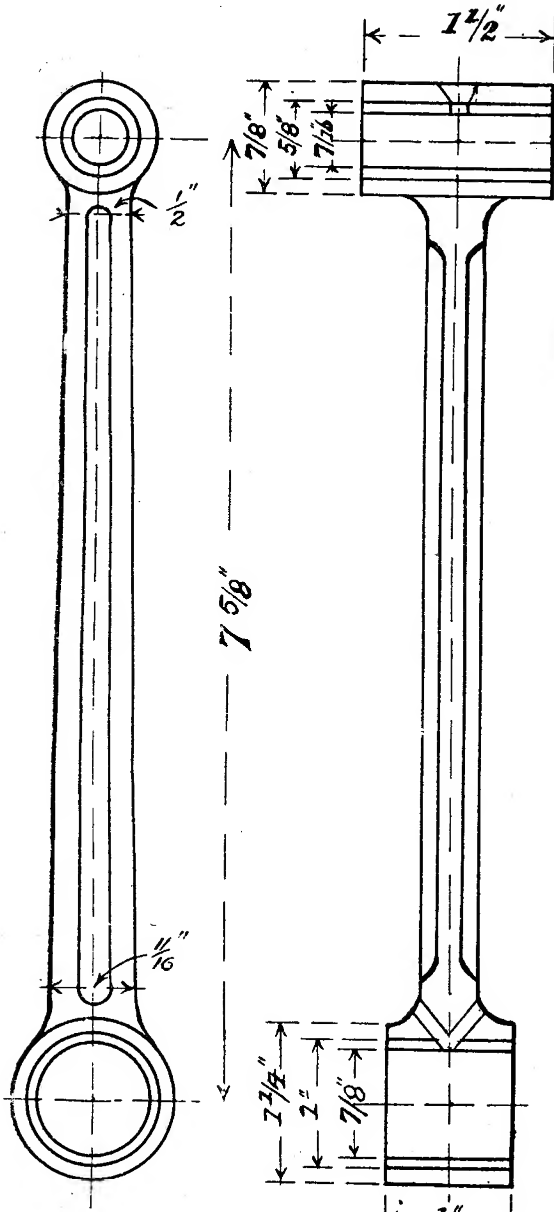


Fig. 66.

unless the motor is kept moving through the atmosphere at a high speed, the casting—especially about the combustion chamber—gets so hot that, from causes given, the engine stops.

Now, in designing this motor, and fixing the thickness of metal, I had many things to take into account. First of all there is the pattern-making, then the moulder's skill, and equally or even more important the character of iron used; so that if all three should be indifferent, a motor designed on the finest lines would probably never get finished at all, or, if it did, would fracture on first usage.

Consequently, when these three conditions are unknown to the designer, it behoves him to sacrifice something of high efficiency in his distribution of metal to secure workable conditions on the average.

The cylinder drawings in the last article show the wall as 3-16ths in. thick; yet, in a motor I have just been testing, the wall is 1-16th in. thick only, and yet it stands the stress of high compression and consequent initial pressure on explosion perfectly, with corresponding advantages as to cooling effect.

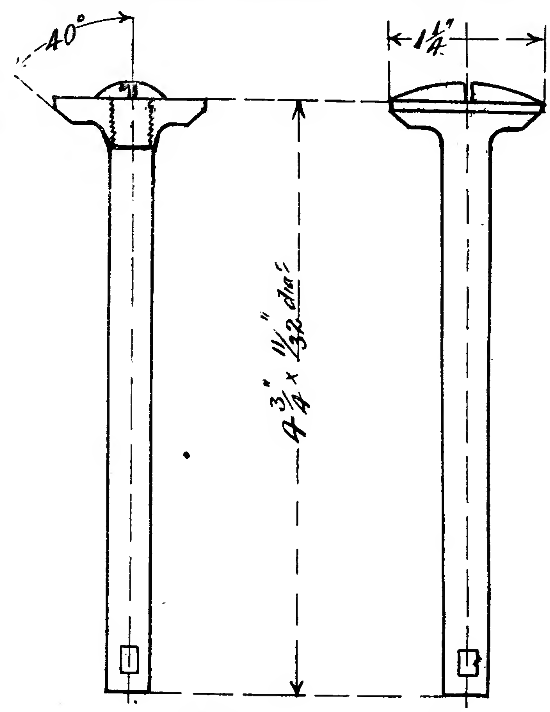


Fig. 67. Fig. 68.

But such a design would be ridiculous for any amateur to attempt, and would simply be courting failure, for, in the first place, long experimental tests of an elaborate nature were undertaken to determine the proper kinds and mixture of iron to stand the pressure; then the patterns were made and re-made, improved upon at each stage, and finally produced in a special white metal alloy carefully machined to the last half-ounce; finally the cylinders themselves were bored in automatic turret-head lathes fitted with special elaborate jigs, which did not permit a variation of a-thousandth part of an inch between one casting and another, except it should be due to wear of the cutting tool, which, again, would be removed by the adjustable reamer which followed, this reamer being maintained to size by gauge limits of 0·0005 of an inch.

In such a case, the slightest approach to a flaw in the casting would be fatal; but, although this may occur, and does occur, it is of no moment in a fac-

tory dealing with hundreds, but the amateur working out a single machine with the best tools at his command cannot expect to attain such results.

Hence, if I have erred in the design, it is on the side of safety, and, if the more experienced amateur cares to stake his own judgment, it is quite possible

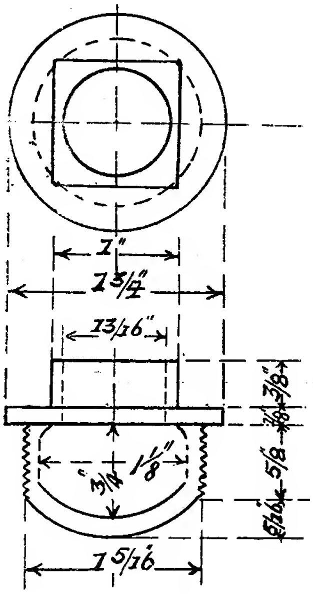


FIG. 69.

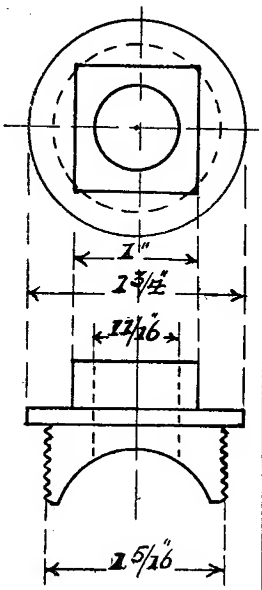


FIG. 70.

to safely pare away a lot of metal from the design I have given, and yet retain enough strength, under favourable conditions, as to metal and workmanship. The points, however, which should not be departed from are the internal measurements and relative areas of combustion chamber and cylinder.

To resume the work in the piston; it will be noticed that the diameter at the centre is somewhat less than at the two ends, and that the two ends are a trifle less than the cylinder bore; the latter is necessary to allow of slight variation in expansion and contraction, as without it the piston would surely seize. The further reduction in the centre assists in the lubricating oil reaching the piston-rings.

The cross-bore for the steel pin must be very accurately centred by making a scribing line with a point tool at the same chucking as the grooves are turned, and then the opposite diameters may be found by division plate or any other convenient method, and a small twist drill set through to clear the way for a larger one.

It will be noticed that the screwed end of the cross-pin is $\frac{3}{8}$ in. diameter and the other end 7-16ths in. so a good plan is to enlarge to nearly $\frac{3}{8}$ in. (tapping size) and then pass a reamer through to produce the straight line; next enlarge with another reamer to full 7-16ths in. on one side where the locking screw is to come; this hole will then give clearance and form a guide for the $\frac{3}{8}$ in. tap.

Some makers give a very slight taper to the plain hole, which ensures the pin screwing up firm; and if a suitable tapered reamer is at hand this may be done, but it will be necessary that the taper on the pin itself shall be the same, otherwise the plain, straight hole will be better, the object in any case being to firmly fix the pin, and the danger being anything working loose inside the cylinder; consequently, the locking-screw itself must be a very good fit, and the best makers usually adopt some device for preventing it rotating and so working out, as it is astonishing what a lot of damage this screw can do if it gets astray.

The cross-pin forming the bearing for the connecting-rod must be of case-hardened mild steel, and it should be turned just a trifle shorter than the diameter of the piston, so that both ends are quite clear of the cylinder bore; its head is slotted with the hack-saw for tightening up by screwdriver, but this pin should not be finished until the connecting-rod is ready, as it is easier to turn the pin to fit the hole than to enlarge the hole to fit the pin.

The piston-rings are turned out of cylindrical castings formed of hard, but tough, close-grained iron; the size is given in Fig. 63, by which it will be seen the rings are about double the thickness at one side, the thickest portion being opposite to the diagonal slot cut across to allow of the ring being sprung into position, the amount of eccentricity to allow for this variation in thickness being 1-32nd in., and the proportion being rather exacting, as, if the difference is greater, the ring will likely break on the thin side in stretching into position; or, if the fault is in the opposite direction of too much equalisation of strength, the ring will not be springy enough when working in the cylinder.

The connecting-rod (Fig. 66) is a simple enough job in appearance, but it is not so in reality, for it has a big duty to perform, and of a very exacting

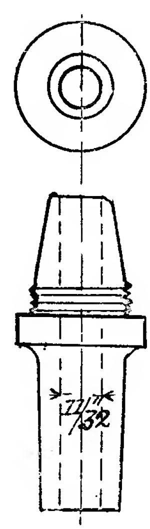


FIG. 71.

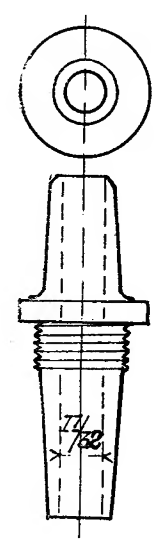


FIG. 72.

nature. In an engine of this size it is of vital importance that there shall be no binding action anywhere; yet all must be as nearly as possible a perfect fit, so that there is no lost motion.

In the practice of the larger makers of small motors nothing varies more than the connecting-rod in the matter of the metal employed, its form, weight, and treatment, and whether it shall be bushed at the bearings with hard steel or phosphor

bronze, or simply case-hardened. As I have made the drawings, the connecting-rod is bushed either with gunmetal, phosphor-bronze, or hardened steel. As to which is preferable depends—or will be con trolled—by the capacity of the maker, though, with no difficulty in the way, the hardened steel bush should certainly be employed at the upper or piston end; but with regard to the big end the total results might no doubt come out better in phosphor-bronze, because any inaccuracy of workmanship, or subsequent distortion, would cause less binding action and more quickly right itself than in the case of a well-made hard steel bush being employed.

Similarly, the connecting-rod itself may be either cast in phosphor-bronze, or in steel, or in malleable iron, or it may be a drop forging in mild steel; of these, the phosphor-bronze or gunmetal casting is the only thing available to the amateur, because the rest are obtainable only in considerable quantities.

The only remark that appears necessary in relation to the machining of the connecting-rod eye is to say that they must be parallel to each other, at right-angles to the rod itself, and each bearing exactly divided one-half each side an imaginary centre line drawn through the entire length of the face-view of the connecting-rod. If bushed, of course, the bushes must be securely fixed by slight taper and inserted under pressure; in any case, provision must be made to prevent rotation under any ordinary circumstances, as it will be seen that each bush has oil-holes drilled through to admit oil from the splash lubrication of the crank chamber; but I am not in favour of this system, on account of the danger of them working loose.

Figs. 67 and 68 show alternative designs for the valves, same dimensions applying for inlet and exhaust; the only difference between the two is that Fig. 67 has a screwed-on head of solid nickel, whilst 68 is turned from one piece of steel.

Figs. 69 and 70 are the plugs covering the valves and the cylinder cover centre. Of Figs. 69 we shall require two, of Fig. 70 one only will be needed, this plug being hollowed to accommodate the sparking-plug, whether placed centrally over the cylinder or over the inlet valve. Fig. 69 is hollowed out, as shown, in order to prevent retention of heat, and both patterns have square heads, which will be found preferable to the usual hexagon head for this purpose, as the expansion and contraction at the immense heat attained has a great effect on screwed work.

The centre of Fig. 70 is, of course, threaded to fit whatever plug is used; but the De Dion standard of 11-16ths in. diameter by 17 threads is now almost universal.

Figs. 71 and 72 almost explain themselves; they are simply gunmetal guides for the valve-rod mechanism; Fig. 71 screwing into the underside of the exhaust and inlet chambers and guiding the valves, whilst Fig. 72 screws into the distribution gear box on the crank chamber and guides the lifting rods operating the valves, two of each pattern being required.

(To be continued.)

An obdurate screw may sometimes be drawn by applying a piece of red-hot iron to the head for a minute or two, and immediately using the screw-driver.

The Electric Lighting of a Private House.

By Frederic H. Taylor, Assoc.M.Inst.E.E.

VI.—The Materials and Accessories Used.

(Continued from page 322.)

Distribution Boards.

As already pointed out in the earlier part of these articles, a "distribution board" (or "distributing" or "cut-out board" as it is sometimes called) is designed for the purpose of collecting together as one piece of apparatus the various circuit fuses controlling an installation, or, controlling some section of an installation, such as one of the floors of the house.

Distribution boards are commonly double-pole, and may have either the milled nut fuse terminals, or, as is more usual, be provided with china spring clip bridge pieces. Fig. 55 shows a six-way double

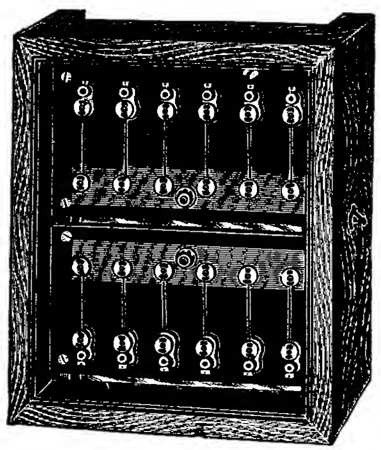


Fig. 55.—Double-Pole Fuse Board with Milled Nut Terminals.

pole board complete, and with milled nut terminals, the fuse-wire having been inserted in each way. In this type of board it is obviously inconvenient to replace a fuse which may have blown without first throwing off the switch of that circuit owing to the splutter of sparks which may occur as one puts the fuse-wire under the terminal. China bridge pieces with spring clips overcome this trouble, as the fuse wire can first be inserted in the removable bridge, and this then put back in its proper way on the board. Figs. 56 and 57 show respectively a complete board of this type (six-way, double-pole) and an enlarged view of one of the bridge pieces with its fuse-wire in position.

The bus bars, or bars which form the common connection for each way on either pole, are sometimes provided with a screw nut connection, either at front or back, and sometimes with a sweating socket at back. Obviously, the latter arrangement is by far the best. Frequently, the bus bar and also the various circuit terminals are mounted on one piece or "panel" of enamelled slate or glazed porcelain. An arrangement, which is electrically much

better, is to mount each way on a separate panel, these various panels being fixed on to one common piece of varnished teak.

The specification for a good class distribution board suitable for high voltage work would be the following :—

1. The positive and negative portions to be separated by an approved porcelain division piece, securely held in position. A polished teak frame to

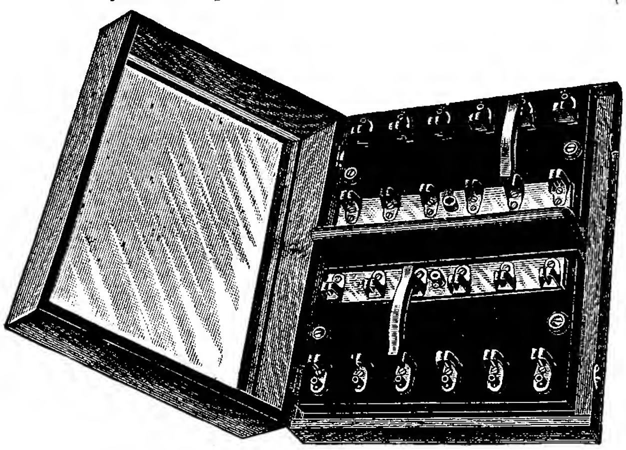


Fig. 56.—Double-Pole Fuse Board with Spring Clips.

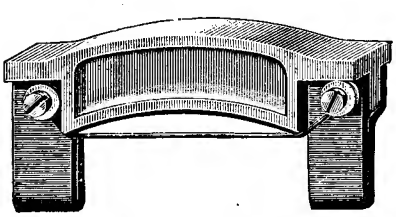


Fig. 57.—Fuse-way for above Board.

surround the whole with a glass-framed door to match, open back, and a lock and key.

2. Each way to be mounted on a separate porcelain slab, which slabs are to be secured to two varnished teak battens.

3. Each bus bar to be provided with sweating socket.

4. All conducting metal work to have sectional area for current density not exceeding 1000 amps. per sq. in.; the density at the actual area of the contacts not to exceed 300 amps. per sq. in., with the maximum current passing.

5. Length of break of fuse in no case to be less than 2¼ ins. as measured between the nearest conducting metal parts, and spring clip bridge pieces only to be used.

6. Each fuse way is to be clearly labelled to show the circuits it feeds.

The last point is one which is hardly ever adopted by the average wiring contractor, and yet what an endless amount of trouble and waste of time may be saved by its adoption, which costs practically nothing.

The Simplex Steel Conduit Company have listed a distribution board specially suited for use with their conduit systems. An illustration of this is shown in Fig. 58, and one of the fuse-ways is shown in Fig. 59, from which it will be noted that each way has a separate "panel" to itself.

Although the positions for the distribution boards in a house are commonly chosen so that the runs of wiring are not unduly long, or so as to be as near as possible central with regard to the lighting circuits to be fed, these positions should be dry, readily accessible, and such that the boards do not constitute an eyesore.

Cases sometimes arise, as for instance, in the lighting of large conservatories and winter gardens, where no dry position can be had, when it becomes essential to use a watertight distribution board. These are commonly contained in a cast-iron case, with door closing on a rubber packing case. Owing to the unavoidable condensation going on in such a building due to the changes of temperature and humidity of the atmosphere, the writer is of the opinion that an ordinary distribution board inserted

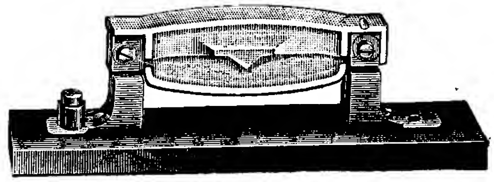


Fig. 59.—"Simplex" Fuse-way.

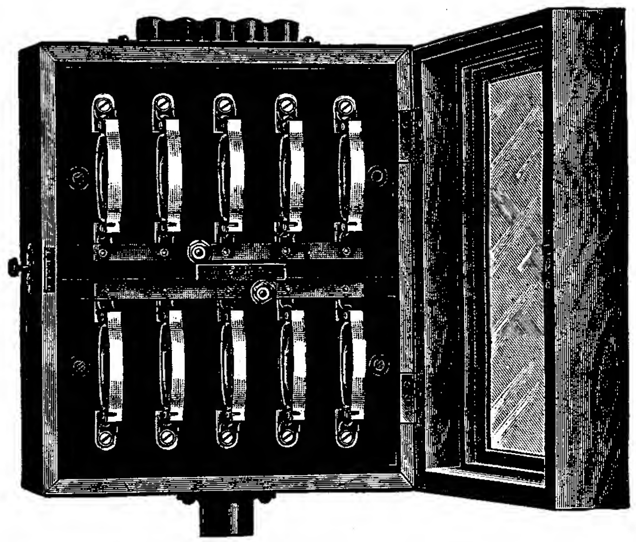


Fig. 58.—"Simplex" Double-Pole Fuse Board.

in a suitable teak box, which has been made thoroughly damp-proof by being pitch-lined throughout, is more satisfactory.

The fuses of all distribution boards should be occasionally examined, as the small setscrews which hold the fuse-wire in position may, by the vibration which occurs to some extent in every house, become slackened, and thus by bad contact cause the fuse to blow. In such a case the fuse blows practically speaking, *at* the terminal, whereas a *bona fide* ex-

cess of current causes the fuse to blow approximately in the centre of its length.

INCANDESCENT LAMPS.—Although a very common-place article, the ordinary incandescent electric lamp calls for several points which ought to be considered.

A really good, well-made lamp is absolutely essential if the installation is to have freedom from trouble and, although the writer is perfectly unbiassed in the matter, preference generally goes to the British made article.

Unlike many ordinary articles of daily use, the inferiority of a bad lamp is not in any way apparent to the ordinary layman, in fact, in some cases, hardly so even to an expert.

The points to be looked for in a good lamp are:—(1) A good vacuum. (2) A well-made filament of uniform section. (3) Vitrite or a similar composition for the fitting of the brass collar in preference to plaster. (4) Where small candle-power, high voltage, or high efficiency necessitate a long or *mechanically* weak filament, this should be "anchored" or stayed.

Upon the efficiency of the lamps used depends, of course, to a great extent the "running" cost of the installation for current. By "efficiency" one means, of course, the ratio of the candle-power obtained to the electric energy supplied, and this is commonly expressed as so many "watts per candle-power." A lamp taking 3·5 watts per candle-power would be considered of moderate efficiency. High efficiency lamps may be had as low as 2·5 watts per candle-power.

As the efficiency is increased, the life of the lamp is decreased, owing to the higher working temperature of the filament. In the early days, when only low voltages were in use, people became accustomed to the ordinary 100-volt 16 c.-p. lamp with its life approximately 1000 hours. In the present day, however, with higher voltages and a desire for better efficiency, 800 hours life is much more common. As the lamp blackens through age, it pays to throw it away and get new, for although the consumption of current may be decreasing, the candle-power is decreasing at a far greater rate.

The question has often been raised as to whether it pays better to use a low efficiency long-lived lamp or to use a short-lived high efficiency lamp and spend more money in lamp renewals. From records of actual tests, the writer is of the opinion that the greater economy in "running" cost is obtained by the adoption of the high efficiency lamp; certainly, with the ordinary ruling rates for electric current.

FITTINGS.—The term "fittings" is commonly applied to electroliers, pendants, brackets, standards, etc. Of these, there is, of course, an endless variety of designs which is constantly being added to, and to attempt a description even of a general nature would occupy considerable space with but little resulting good. There are, however, some few points which should be looked to when choosing electric light fittings, and amongst these may be mentioned the following:—

Parts soldered together.—In cheaply made brackets and electroliers, it is not uncommon to find scrolls and nurls soldered on to the arms which carry them instead of being screwed. Such a method is, of course, essentially bad.

Holes for flexible cords.—With the present tendency for fittings of a *very light* description flexible cord often forms an essential part of the design, and care should be taken that any holes through which the cord has to pass are properly bushed with ebonite, ivorine, or other insulating material.

It is the custom with many manufacturers to list and sell fittings bare, that is to say, lampholders, and shades, etc., are not included in the prices of the fittings. It is desirable to see that the holders which are to be used are, if possible, supplied by the same maker in order that they may properly match in colour with the rest of the fitting.

Unless it forms part of the design, flexible cord should not be used to wire fittings. 3-23 or 3-25 electrolier wire should be used, which is an ordinary vulcanised wire with specially thin insulation. A better plan still, though one which is not always possible, is to take the actual circuit wires right through the fitting to the lampholder.

(*To be continued.*)

How to Make Vacuum Tubes.

By P. MIDDLETON.

I NOTICED in THE MODEL ENGINEER, some few months ago, that a correspondent was desirous of making a vacuum tube, and, as I have successfully constructed one, I send you a description of its manufacture, hoping that it may be of use to him and other readers also.

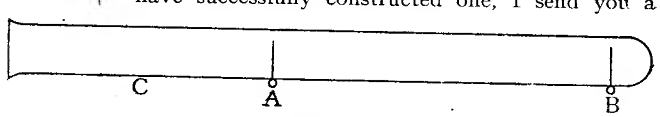


FIG. 1.

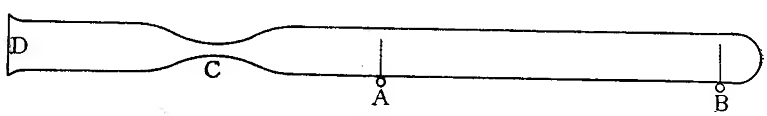


FIG. 2.

The tube itself I made out of a test-tube about 15 c.m. long and 1·5 cm. diameter; but, of course, there is no necessity to keep to this size or even shape; but, for simplicity, I will describe the making of one to these dimensions.

The tube can be obtained at any large chemist's; but as you are likely to break some (as I did) it would be best to get a dozen, costing about 6d., according to size. It is important to see that they are made of thin glass, or they are likely to crack during the subsequent operations.

Having obtained the tube, and thoroughly cleaned it, proceed to seal into the glass two platinum wires (a process described later), as at A and B (Fig. 1). Now, holding the tube at each end, and horizontally, introduce the part marked C into the flame of a spirit-lamp or Bunsen burner, at the same time turning it round so that it may become evenly heated all round. When it begins to get soft gently pull the ends asunder, and with a little care you should get a tube of the shape shown in

Fig. 2, with the narrow part C about 2 mm. in diameter.

When the tube is cold insert a *rubber* cork in the mouth D of the tube (Fig. 2), and into the cork a long glass tube about 3 mm. internal diameter, and at least 80 cm. long. Having got it perfectly air-tight, fill the tube and test-tube completely with pure, clean mercury with the aid of the funnel shown in Fig. 4. Now

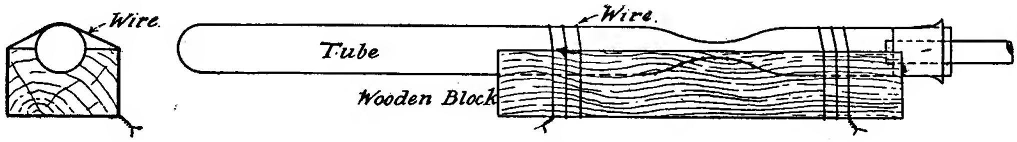


FIG. 5.

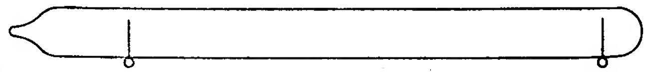


FIG. 6.

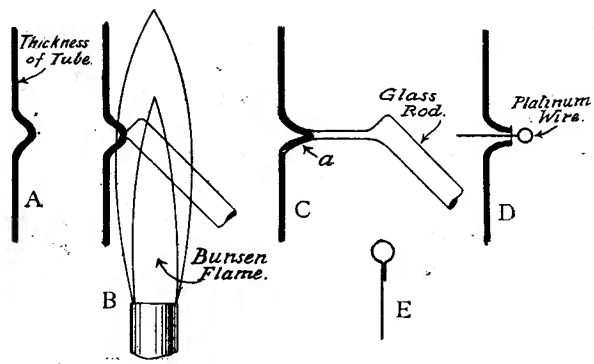


FIG. 7.

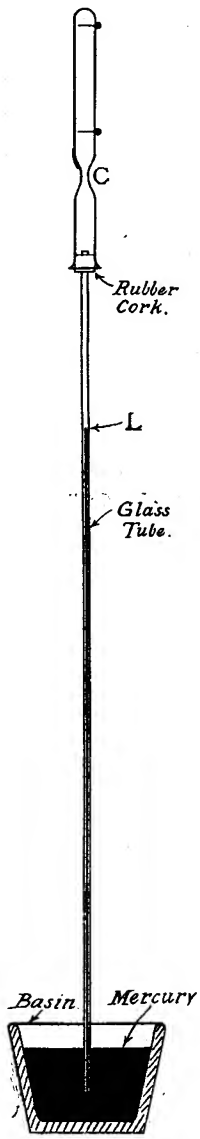


FIG. 3.

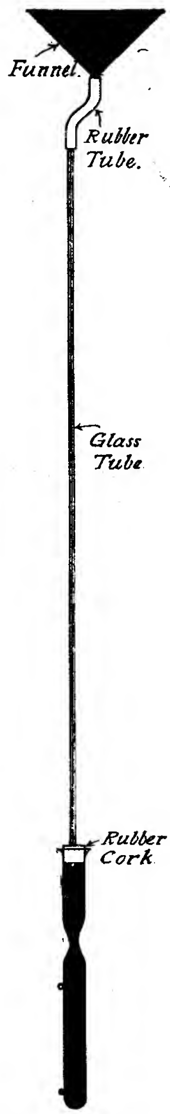


FIG. 4.

remove the funnel, and seeing that the long glass tube is filled to the top, close it by pressing your finger tightly over the end; now invert the whole apparatus, and place the end of the tube under the surface of mercury in a basin (Fig. 3, and remove your finger. The mercury will leave the test-tube, and sink to a level L in the tube, leaving the space above it in the test-tube a fairly good vacuum.

But here a word of warning. When inverting the apparatus full of mercury, it must be remembered that the great weight of the mercury in the test-tube is supported by the thin glass tube at C (Fig. 2); the test-tube must, therefore, be supported during its transit, and the best method of doing this is explained by Fig. 5. The vacuum being created, all that is necessary is to seal up the tube at C; this may be done as follows:—While the apparatus is still standing in the basin of mercury, direct the flame of a small mouth blowpipe on to the part C (Fig. 3); as soon as the glass gets soft it will be seen to bulge inwards due to the pressure of the air on the outside. Allow this bulging to continue, and it will completely seal up the tube, which will then be finished, as depicted in Fig. 6.

To seal in the platinum wires, proceed as follows:—Cork up the test-tube (preferably with a rubber cork), and pass it rapidly two or three times through the flame of the Bunsen burner in order to increase the pressure within; now direct the tip of the blowpipe flame towards the part of the tube in which the platinum is to be sealed. When

it gets hot it will bulge outwards (A, Fig. 7), and after this bulging has assumed about the proportions shown remove the flame.

Obtain a short piece of glass rod or tube, and hold it in the flame till the end is red-hot ; touch it on to the end of the bulge, when it will stick to it (Fig. 7, B).

Removing them from the flame, and *immediately* pulling the glass rod from the tube the form shown in Fig. 7, C, will be obtained. When the glass is cold, make a nick, with a file at *a* (Fig. 7, C) and break off the superfluous material ; the opening thus obtained is shown in section in Fig. 7, D. Into this opening place the previously prepared platinum wires (which should be bent to the shape shown in Fig. 7, E), and direct the blowpipe flame upon it, when the glass will melt and hermetically seal the wire in its place.

It is essential that platinum wire should be used, on account of its being the only metal whose co-efficient of expansion is practically the same as that of glass, being ·0000088 ; (glass, ·00000886), otherwise the different rates of expansion would result in the cracking of the glass. A tube made by this method will give a good glow on a ½-in. spark-coil, and with a 6-in. spark-coil become very brilliant.

The making requires a little skill in glass working, but there is no special difficulty, and I hope the instructions will enable anyone to construct a vacuum tube, which, if it is not as good as shop-made articles, will prove the possibility of their construction at home.

It is of interest to note that the original British patent granted to the Hon. C. A. Parsons in 1884 for his steam turbine, has expired. Of course, as in all real inventions, many modifications and improvements have been introduced by Mr. Parsons, so that his patents still control many of the essential features in a satisfactory steam turbine capable of developing a high efficiency.

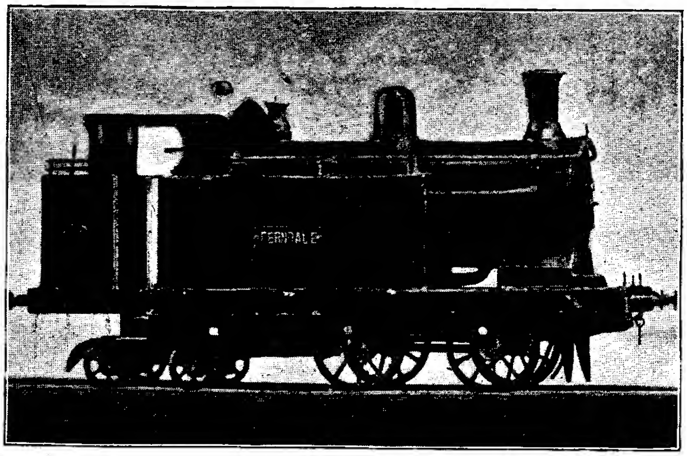
Four Simple Locomotives.

Described by the Builder.

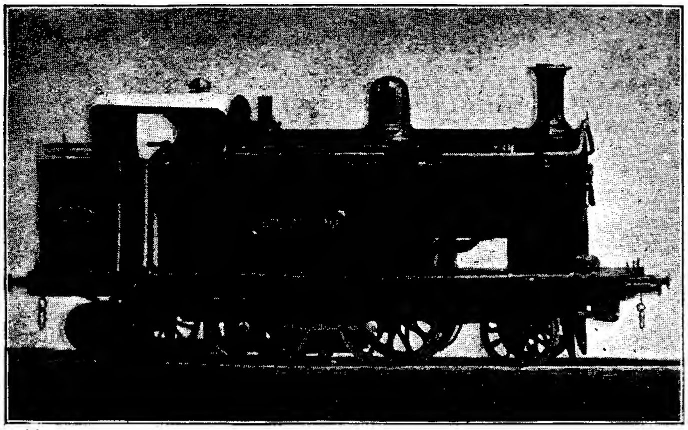
(*Continued from page* 309.)

In the construction of the two models about to be described, a 17/6 lathe and an old wood-turning lathe were used.

Locomotive No. 63, " Ferndale," is a four-coupled trailing bogie tank engine, rather different in general build to the preceding ones. The framing, which is 14 ins. long, and 3¾ ins. wide, is made in the same manner as the others from sheet tin. The coupled wheels, which are 2 ins. diameter, are spaced 3 ins. apart, the overhang at the leading end being 3 ins. The bogie is nearly the same as that of the main line engine, the only difference being the wheel centres, which are 2 ins. apart. The distance between centre of rear coupled wheel and centre of bogie is 4¾ ins. All bearings are pieces of ⅛ in. sheet brass, soldered on.



The Third Model Locomotive—" Ferndale, No. 63."



The Last of the Four Models—" Ecclesbourne, No. 124."

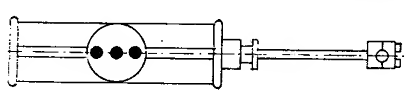
The front pair of coupled wheels are the drivers, the axle having a single crank which is actuated by a double-acting oscillating cylinder, ½-in. bore, 1¼-in. stroke, placed inside the frame and fitted with a reversing gear of the same pattern as the other engines. The pipes are connected up in a slightly different way, as shown in Fig. 10, which I think explains itself. Having the cylinder inside allows of the coupling rods being placed at right-angles to each other ; the latter were at first of brass, but have been replaced by iron ones.

The boiler is made of No. 12 sheet copper, 2¾ ins. diameter and 7½ ins. long. The longitudinal joint is riveted, and the ends flanged the same way as the goods engine, all joints being soldered. It is something after the style of Mr. Smithies' boilers, a sketch of it being shown in Fig. 11*a*. It was originally intended to be fired in the same manner as the others, and went all right till I got the side tanks

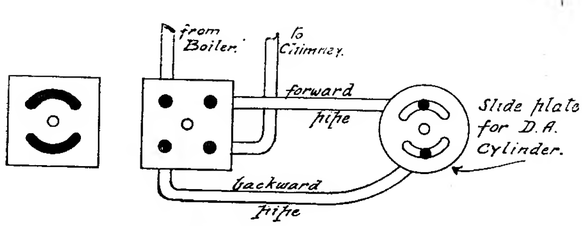
on, and then the trouble commenced. The tanks prevented the hot fumes escaping, and the lamp kept going out, so I therefore made a tin firebox shaped casing like that used by Mr. Smithies on his tank engine, and fixed it on, finding a fresh trouble. The smokebox and chimney were soldered up, and if I had let the hot fumes of the lamp go into this, the result on the first trip would have been disastrous. I did not care for the job of pulling the smokebox and chimney all down again and making them up afresh with riveted joints, so I adopted the simple expedient of cutting the tin firebox casing short at the end of the side tanks, and letting the hot gases escape there, which arrangement acted very well, as I was never troubled with lamps going out or shortness of steam again (see Figs. 11*b* and 11*c*).

When the tin firebox was first put on, I fired her by means of a six-burner spirit lamp; but just lately I have done away with this, and have fixed up a small paraffin blowlamp instead, similar (but smaller) to that described by Mr. Caparn for his steam-roller, in THE MODEL ENGINEER of April 2nd, 1903. It cannot be seen in the photo. A rectangular tank is fitted into the coal bunker, having a cycle-tyre valve and filling plug fitted to it; the pipe leading to the burner comes out underneath and passes under the footplate into the firebox where it is bent round to form the coil. There are three turns ½ in. diameter and a piece of iron gauze over the top to spread the flame. The burner is simply a very tiny hole drilled in the pipe at the bottom of the coil. The tubing is ⅛ in. inside diameter, and has a small cock fixed on to regulate the oil-supply, as the lamp, being so small, is liable to "squirt" when first started. It works fairly well, does not smoke, keeps about 15 lbs. of steam, and needs no attention other than an occasional pump up; but if by chance the oil runs low and it goes out, it makes a smell large enough for a full-sized locomotive; in fact, it "speaks for itself."

The boiler mountings are pretty much the same



CYLINDER.



REVERSING GEAR.

FIG. 10.—DETAILS OF MODEL LOCOMOTIVE "FERNDALE."

as the other engines. The chimney was originally a built-up, straight, tin one, but has been replaced by a brass casting, turned up and painted black, leaving the cap bright, like the Brighton engines of Mr. Stroudley's design. The safety-valve is something like the old Great Northern, and is shown in section in Fig. 12, which needs no explaining. It unscrews, leaving a place to fill the boiler as there is no pump. The footplate fittings are less in number than those of the tender engines, the test cock at the bottom of gauge glass and the water cock at the side being dispensed with. The reversing lever in the cab is rather awkward to get at for driving, so I fixed a small auxiliary handle to the reversing rod under the edge of frame, and this can be

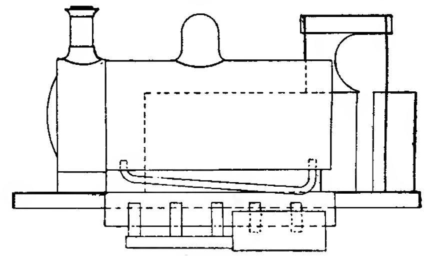


FIG. 11*a*.

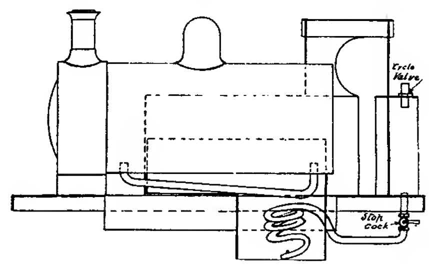


FIG. 11*b*.

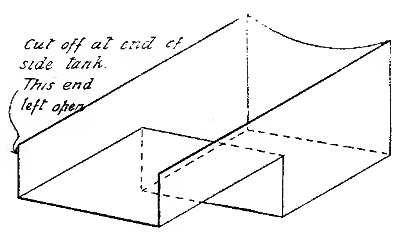


FIG. 11*c*.

DETAILS OF BOILER FOR THE "FERNDALE."

operated from outside. The regulator, blower, etc., are the same as those of the goods loco. The usual details are added—spring buffers, coupling chains, guard irons, hand-rails, dummy sand and condenser pipes, lamp irons, &c. The whole is painted green, lined black and red; the name plates are aluminium, showing silver letters on a green ground, and the number plates are brass, with the words, "Great Southern."

A very similar locomotive to the one above described is the "double-ender" tank engine shown in the last photo. She has leading and trailing wheels 1½ ins. diameter, and four-coupled drivers 2¼ ins. diameter. The frame is 15 ins. long and 3¾ ins. wide, and is cut and bent in a similar manner to the goods engine one. The cylinders are inside, and drive the leading coupled wheels; they are 9-16ths in. diameter and 1¼-in. stroke, single action oscillating type, built up from pieces of drawn brass tubing. The cranks on the driving axle are, of course, set at 180 degs., or right opposite to each other; but the outside coupling rods, which are of iron wire, flattened and filed to shape are at right-angles, as in

actual practice. This engine has the same kind of reversing gear as the preceding ones, the manner in which the pipes are arranged being shown in the accompanying Figure (13).

The leading driving and coupled axles have rigid bearings, which are only pieces of $\frac{1}{8}$ in. sheet brass

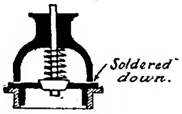
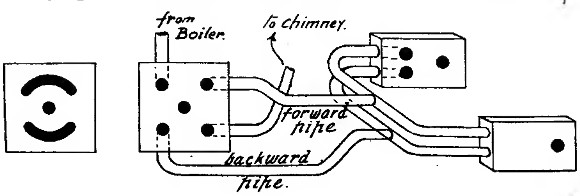
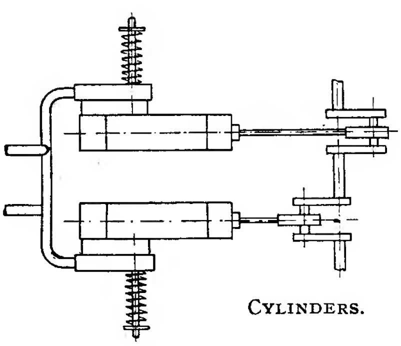


Fig. 12.—Safety Valve for Model Locomotive "Ferndale."

soldered to the underframe, having holes drilled through for the axle to revolve in; but the trailing wheels and axle are mounted on a sort of radial frame controlled by springs, which allow a little side play when the engine is rounding a curve. A diagram of the arrangement is shown in Fig. 14. A shows the top of the small radial frame, which I will call the "pony" for the sake of distinction. Four pieces of $\frac{1}{8}$-in. diameter brass tube, each $\frac{1}{2}$ in. long, are soldered to each corner. Two iron wires pass through these, and are attached to the underside of the engine frame, so as to let the pony slide sideways upon them, as shown at B. Another piece of iron wire, crank-shaped, is soldered to the pony frame at *c*, and this slides in two bearings also attached to the underside of the main frame. Two spiral springs of brass wire are placed over the crank, shape piece, the outer ends of them resting against



Reversing Gear.



Cylinders.

Fig. 13.
Details of Model Locomotive "Ecclesbourne."

the bearings *d,d*. Now, if the engine is on a curve, the pony and wheels will slide sideways, left or right, according to the direction. Supposing it to be a right-hand curve, the pony truck slides in that direction, taking the cranked wire with it and compressing spring *e* against the bearing *d*. As soon as the curve is passed the spring "pulls her straight" again. When this engine was first built there were no springs on the pony, and when taking curves at a high speed I found she very often jumped the road when coming into the straight, and *always in the same direction as the curve.* Since I fitted the springs she has never been guilty of this act, and the pony, although design and workmanship are both pretty rough, works very well.

The boiler, which is $2\frac{1}{2}$ ins. diameter and 9 ins. long, is made from a piece of solid-drawn tube 1-16th in. thick, with two ends 3-32nds in. thick; a $\frac{1}{8}$-in. brass stay passes through the middle, having a nut on each end, the ends of the stay being cut short, hammered down over the nut, and all joints well sweated with solder. It is exactly the same pattern as that of the bogie tank, only the middle water tube is coiled once round over the flames of the lamp; the mountings are also alike, with the sole exception of the safety-valve, which is after the style of the one on the goods engine. A sketch of boiler and of the lamp is shown in Fig. 15; it is fed through a pipe coming from the back of the coal bunker. It has eight burners, which are stuffed

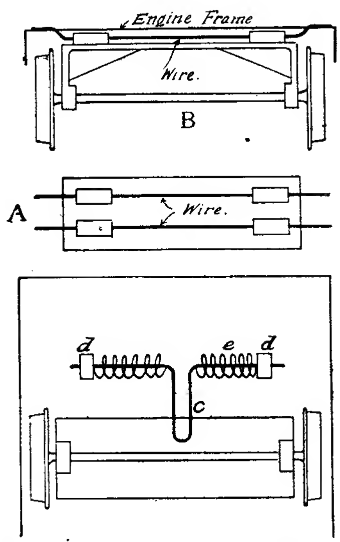


Fig. 14.—Pony Truck Details.

with asbestos yarn, and a 1-16th in. brass tube is fitted into the main reservoir, as shown, in order to burn the fumes which arise when the lamp becomes heated, and so obtain all the heat possible. When the lamp is in position under the engine, the back reservoir bears a strong resemblance to the Westinghouse air reservoir on a full size loco.

This apparatus makes plenty of steam; but it constantly requires attending to and feeding with spirit; so I am about to do away with it, and fit an oil burner as fitted to the bogie tank. I might here mention that this engine when running light would sometimes fly off at a terrific speed, and "mop" up a bank of one in five as though it were downhill instead of up; and if with a load she would slip enough to knock herself to pieces. I wondered how this was, as she seemed to be all in good order, the safety-valve acted all right, and she did not stand about to gain a lot of steam. There is no steam-gauge fitted, so a little while back I borrowed a big steam-gauge, made a temporary connection, and tested her, and found the reason. The lamp would get hot, and when I poured a fresh supply of spirit

in, it caused a stream of vapour to rush out of the pipe in the main reservoir, and play a flame like a blowlamp round the water-tubes in the boiler bottom, making them almost red-hot and generating a tremendous amount of steam. You can judge of my astonishment when the needle of the gauge went round to 55 lbs. before the safety-valve "popped"! I have never wondered at her speed since. My only wonder is that she did not burst and put an end to

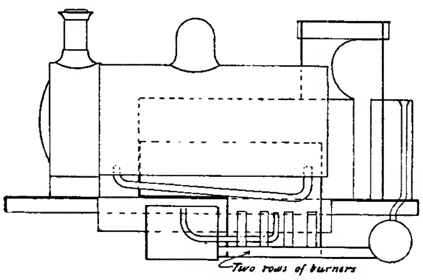


FIG. 15.—BOILER OF MODEL LOCOMOTIVE "ECCLESBOURNE."

my model building for good and all; she blows off at 30 lbs. now, which is a little safer, I fancy; but let us return to the description.

The smokebox is of tin, 1½ ins. long, and has a dished door with hinges and catch of the usual pattern. The cab roof is hinged, and lifts up so as to easily get at the regulator handle, whistle, etc. This engine has a proper firehole door, which communicates with the firebox, but is more for appearance than use, as is also the sliding flap of the coal-bunker. The side-tanks, cab sides, and coal bunker are all sheet tin, and glass windows are provided, also head-boards and lamps, dummy sandpipes, spring buffers, coupling chains, and drawbar hooks, and all the little details that "make it look real."

The whole engine is painted dark green, lined black and red with a brown framing; the number (124) appears on the front and back buffer beams, also on two brass plates fixed to the bunker sides, which also bear the words, "Great Southern Railway." Aluminium name-plates, with the name "Ecclesbourne" upon them, obtained from a penny in-the-slot machine, adorn the side tanks, an edging of copper wire running round the plates to give them a finished appearance. The gauge of line for all engines is 2 11-16ths ins.

I have built many other engines beside the above, among them being two six-wheel "single wheelers," four bogie "single-wheelers," a ten-wheel four-coupled "Atlantic" express loco, a four-wheels coupled express with the coupled wheels leading, and several other kinds—all of them fairly simple in construction; and if there are any readers of THE MODEL ENGINEER who are just commencing model-building and would care to hear about such things, which are just right for beginners, with the Editor's permission I would be pleased to describe any of them at some future time.

In conclusion, I have found much useful information in the pages of THE MODEL ENGINEER, which paper has been of great assistance to me in all the little difficulties which I encountered with these engines. I find the use of fairly small driving wheels with a long piston stroke gives the best result both for speed and power, and also a model of a goods or tank engine gives better results than a big main line engine. It is all very well to see an express engine racing along a model track, but in my humble opinion a far better sight is a small model tank engine running bunker first with a few carriages behind it; or else a small, six-wheels coupled goods engine making a tremendous fuss and a cloud of steam over seven empty trucks and a brake van.

Hand-Turning Tools.*

By J. DEAN.

IN the following article on hand-turning tools, I have given a description of tools used on hand lathes, and having had many years' practical experience with such tools—both on power and foot lathes—I can heartily recommend them to model engineers; indeed, even now for some jobs I prefer them to the slide-rest. It goes without saying that practice will be needed in their use to attain efficiency; but when a certain amount of skill is achieved, very accurate work can be done by their aid.

Tools for Brass.—The principal tool for roughing-out brass is the tool shown at Fig. 1, which gives top and side view. This tool is about 9 ins. long, and is made from ⅝-in. square steel forged down to about 5-16ths in. square, and ground as at Fig. 1. It is held firmly to the rest, which is *not* placed very close to the work, so as to give a greater range of movement.

As the rest for brass is different from the rest for iron, it would be as well to give a description of it here. It is made from mild steel; the top is 4 ins. long, ¾ in. wide, and ⅝ in. thick, this size being suitable for lathes from 3 ins. upwards. The top part of rest is made smooth and curved in direction of width. In the top part of rest 3-16ths in. holes are drilled about ⅜ in. apart. A steel pin, about 1¼ ins. long is fitted to these holes, so that although

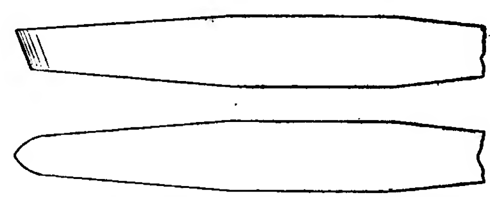


FIG. 1.—ROUGHING-OUT HAND TOOL FOR BRASS WORK.

it fits without shake it is easily withdrawn. Fig. 2 shows front view of rest, end view, and top view.

In using the roughing-out tool, the rest is placed about half-an-inch from the work and a little below the centre, the steel pin being placed in the hole opposite where commencing the work. The tool being placed on the rest close to the pin, at an angle to the work, the handle is pressed downward and sideways towards the pin, causing the point of the tool to be forced into the work. The pin acting as fulcrum, the cut will be in proportion to pressure applied. Fig. 3 shows position of tool from an end

* This article gained a prize in competition No. 33.

view; W being the work, R the rest, and T the tool. To the right hand is a top view, the arrows showing the direction in which the tool is moved and the position of pin.

For finishing, scrapers are used. Fig. 4 represents a flat scraper, the two end edges A and the side edges along the bevel forming the cutting edges. The end A of this tool should not be too thin, as, if so, jarring will occur.

the corners. All edges are rounded off, ground, and filed up, all scratches taken out with emery and oil, and then made (at the end) as hard as possible. After hardening, they are again polished with flour of emery cloth. Fig. 9 is a round burnisher. In use the burnisher is held as the scraper, and, whilst being moved sideways, is pressed against the work with a good pressure. For large, flat surfaces it is held beneath the work; for curves on the top, same

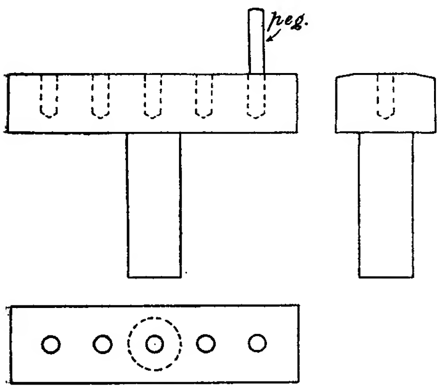


Fig. 2.—Hand-rest for Brass Turning.

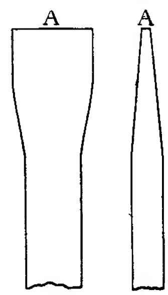


Fig. 4.
Flat Scraper.

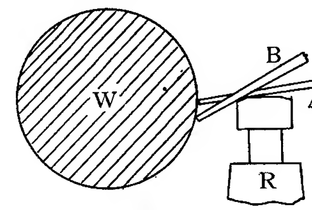


Fig. 5.—Scraper in use.

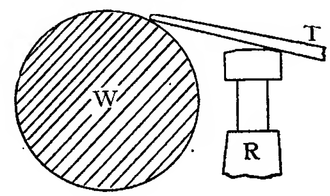


Fig. 6.—Scraper in use.

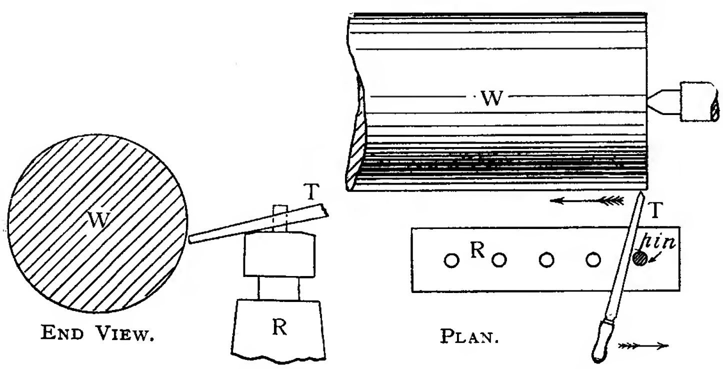


Fig. 3.—Position of Hand-tool and Work.

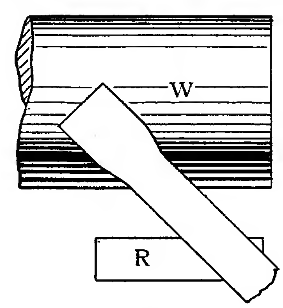


Fig. 7.—Scraper in use.

These scrapers must be held at a greater angle than scrapers for iron. Fig. 5 shows position of scrapers in use:—A scraper for iron, and B scraper for brass; the rest should be in about same position as for roughing-out.

For convex surfaces and long, slender pieces of work the scraper should be held at an angle over the work (Figs. 6 and 7). Scrapers are made from $\frac{3}{8}$-in. square steel about 9 ins. long; flat and round-ended scrapers of various widths are generally all that are needed. By using the flat scraper on edge a parting tool for cutting off work is provided.

Amateurs, as a rule, finish their brass work with emery or other polishing material, and wonder why they cannot obtain a polish similar to that on brass fittings. The reason is simple: brass finishers use burnishers. These are made from $\frac{1}{2}$ in. square steel, and are of various widths and thicknesses. Fig. 8 shows side and edge of burnisher; in appearance they are like scrapers, with the exception of as scraper in Figs. 6 and 7; for small radial surfaces, on top, with sides held vertically.

Burnishers, if they are to work well, *must be kept clean*, and when used the least trace of tallow will keep them from cutting the work and help in the operation of burnishing. To make an oil-cup (Fig. 10) the turner would commence at C with tool (Fig. 1) turning it the requisite diameter for screw. After that he would start work on the hollow portion at the centre of A, working to the right, and then to the left, and coming round the corner D, keeping along the body of cup till finished.

I would here say that in brass finishing the operator should always commence as near the centre as possible, and work outwards. Try to work towards the centre, and note the results.

The scraper would be next employed— a flat one for B, C, and corner D, and a round-ended one for the hollow A. It is afterwards finished with flat and round burnisher, or the flat burnisher on edge for the hollow. C should now be chased. Fig.

11 gives three methods of grinding chasers: A is a chaser hollowed out for steel and wrought iron; B is straight for cast iron; C is ground off, and is for brass. I have given descriptions for principal tools; but modifications can be made to suit special work. If any model engineer will make a set of the above tools he will find himself amply

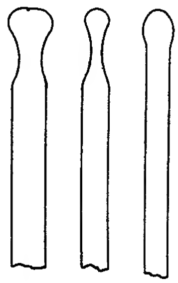


Fig. 8. Fig. 9.

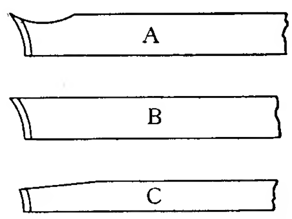


Fig. 11.

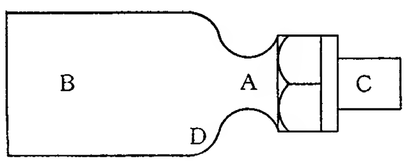


Fig. 10.—Turning an Oil Cup.

repaid, especially when he has learned how to grind and use them.

Tools for Iron.—The speed for finishing ron should be moderately fast, and greater for brass. In order to avoid repetition, the term iron includes steel as well as wrought iron. The first class of tools to notice are hooked, or heel tools, and are used for roughing-out; they are the best for heavy cuts, and are used without lubricants. They can be made either from $\frac{3}{4}$-in by $\frac{1}{2}$-in., or $\frac{5}{8}$-in. by $\frac{3}{8}$-in. bar tool steel. This bar, forged and ground as at A (Fig. 12) is held in a groove in a wooden stock about 18 ins. long by a strap H with a screwed shank (Fig. 13), which passes through the handle C so that by screwing or unscrewing the nut D, the bar can either be fastened or unloosened. Fig. 12 shows complete tool, E wooden stock, C handle, G steel bar with cutting edge at B, F heel, H strap, and D nut, In use, the end E of the stock is held against the right shoulder, one hand grasping the stock. while the other holds the handle C, and moves it laterally, thus causing the tool to move to its cut. The depth of cut is regulated by raising the end E of stock; the heel F is placed on the rest close to the work to keep B, F nearly vertical, for if it inclines too much in any direction it gets beyond the turner's control, and disaster ensues. Fig. 14 shows position of rest and tool. Three of these tools form a set—viz., round nose (*a*), diamond point (*b*), square nose (*c*) Fig. 15. The round nose is chiefly used for trueing up and reducing work to nearly the size required; the diamond point for radial faces and the ends of shafts; while the square nose is used for squaring out recesses, or reducing work by the side of a shoulder after it has been formed by a diamond point.

(To be continued.)

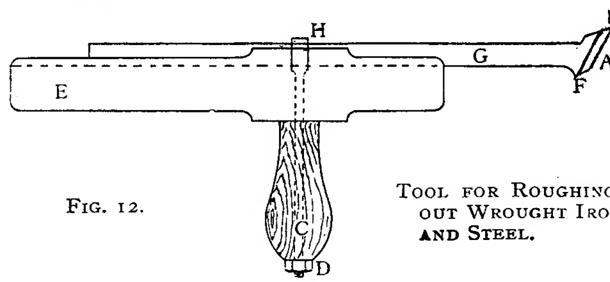


Fig. 12.

Tool for Roughing-out Wrought Iron and Steel.

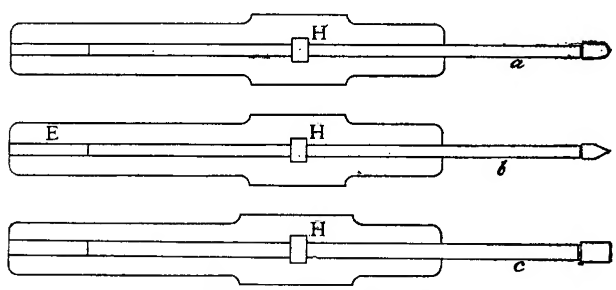


Fig. 15.—Set of Tools.

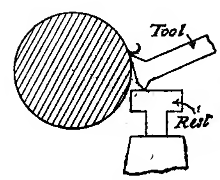


Fig. 14.

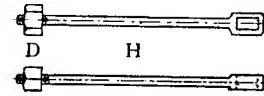


Fig. 13.—Strap.

A New Power Hack-saw.

An ingeniously contrived power hack-saw with two frames, which does any given work in about half the time required by a single saw, has been patented by Mr. Whitley, and made by Messrs. Beanland, Perkin & Co., of Leeds. The machine probably, in view of the gearing, takes a little more than twice the power, though the resistance to be overcome is only about the same, since the saw cuts alternately. It is intended for large works, and a good, strong, slotted table, on which girders, &c., may be firmly bolted, is provided. The frames can be set to cut at any angle, and there is an attachment for ensuring that the blades are put in straight. We are informed that in cutting a 12-in. by 5-in. girder, the opposite cuts will meet within 1-32nd in. The feed is controlled by weights, and a simple device pushes back one of the bows when the centre has been almost reached so that the other may complete the cut. The gear wheels are machine cut, and the various slides and guides are adjustable. The machine will deal with girders up to 14 ins. by 9 ins. The stroke is $5\frac{1}{2}$ ins. The table is 16 ins. by 8 ins.

Practical Letters from our Readers.

[The Editor invites readers to make use of this column for the full discussion of matters of practical and mutual interest. Letters may be signed with a nom-de-plume *if desired, but the full name and address of the sender* MUST *invariably be attached though not necessarily intended for publication.]*

Die Chucks.

TO THE EDITOR OF *The Model Engineer*.

DEAR SIR,—Referring to the die-chuck described by "J. W. W.," in your issue of September 17th, perhaps I may be allowed to point out that the chuck would be much improved by reducing the depth from front to back to 1½ ins., instead of 3 ins. As it stands, half the metal in the chuck is mere useless weight, and involves also unnecessary and harmful over-hang. A minor improvement would be to turn a slight spigot on the body of the chuck, projecting into a shallow recess in the front part or cap; 1-32nd in. would be enough. This would ensure accurate centering of the cap, and also reduce the chance of the two screws which hold the parts together jarring loose.

Personally, I should not much relish the job of getting out a slot of the dimensions shown from the solid. If I were making such a chuck, I would have the front part, at least, a casting (malleable iron, if preferred, though probably ordinary cast iron would be strong enough), and, of course, the slot cast in.—Yours faithfully, J. W. PINKNEY.

Nottingham.

Lieut-Col. Harvey's Electric Locomotive.

TO THE EDITOR OF *The Model Engineer*.

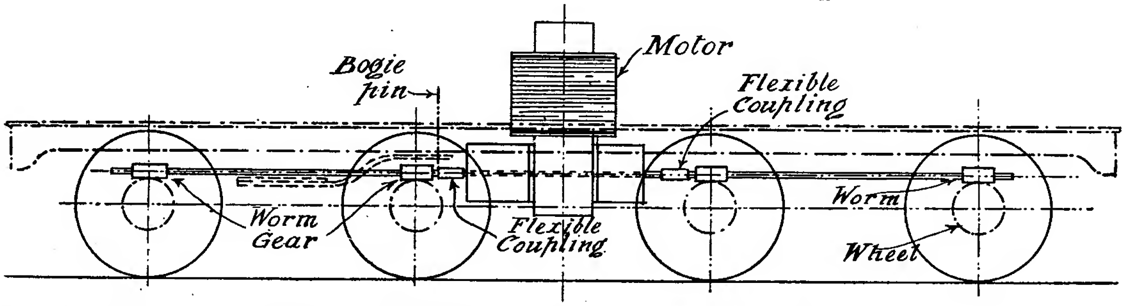
DEAR SIR,—In reply to Mr. A. R. M. Simkins, I do not see how the action of worm gearing of suitable proportions for model electric locomotives can be made reversible, or how a locomotive having this method of driving can be pushed along and the driving wheels made to rotate the armature spindle any more than by endeavouring to impart a reciprocating movement to an eccentric-rod the shaft of a steam engine can be made to rotate in the same way as it could be driven with a crank and connecting-rod. Where the ratio of speed of motor to driving axle is, say, four to one, I have always understood that it is impossible to drive a worm spindle (A, in sketch) by attempting to turn the gear wheel (B, in sketch).

Colonel Harvey's first electric locomotive may be pushed until further orders, but the wheels will either slip, or the teeth of the gear or the worm fail.

I quite agree with Mr. Simkins as to simplicity of worm gearing, and also of the saving in friction, only wishing that some means could be devised to get over the inherent defect of worm gearing mentioned above, as I would only be too pleased to avoid the use of bevel wheels.

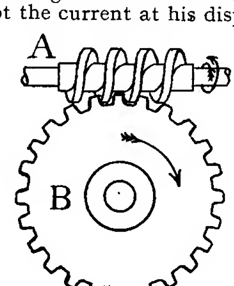
However, to give an idea of comparatively small friction involved in the arrangement of gearing used in the engine in question, I may say that the engine will not stand still on a gradient of 1 in 60. Will Mr. Simkins' worm geared engine do likewise?

I enclose a sketch of the alternative arrangement suitable for a double-bogie electric engine, by which it is possible to drive all the eight wheels with one motor; and to enable to roll for a fair distance after current is cut off I would suggest that the armature spindle be provided with a heavy rimmed flywheel, for, as far as I can see, so long as the armature spindle is kept on the move, the engine will roll; but directly it stops there is a deadlock, and the engine stops dead, or where it has a fair momentum the driving wheels will slip on the rails. Does Mr. Simkins provide some sort of a free wheel arrangement?



AN ALTERNATIVE ARRANGEMENT OF GEARING FOR A MODEL ELECTRIC LOCOMOTIVE WITH TWO BOGIES.

Mr. Simkins endeavours, I understand—and in this he is worthy of the highest praise—to make his engines work with the least power possible, and as his motor is of very small power compared with the weight on the drivers, and as I presume, he has not the current at his disposal that Colonel Harvey has, this gentleman's railway being supplied by rotary converters from the supply mains, he (Mr. Simkins) cannot in any case increase the tractive force of his engine above a certain point.



WORM AND GEAR WHEEL.

However, if Mr. Simkins will kindly turn again to my article he will find that I state that the slipping was due entirely to the weight being transferred to the carrying wheels instead of the drivers because of the curves; but now that the curves of Colonel Harvey's railway are altered from 6 ft. to 13 ft. radius, no trouble should occur, and as the majority

of the weight may now be placed on the drivers very heavy loads and speeds ought to be possible. The alteration in the distribution of weight can be effected in a very few minutes.

It was only in passing very heavy currents through the motor (in endeavouring to obtain the highest speeds) that, with the decreased adhesive weight, slipping occurred. This is a logical consequence of having a high-powered motor; but, at the same time, there is no other objection, as a large motor will work very economically, taking only the current it requires, in ordinary working.

As to the position of the motor, both in dry and wet weather with earth ballast there is a possibility of small stones and particles of grit being "kicked up" by the wheels, &c., at high speeds, and although the motor, as regards fixed obstructions, might be placed as low as $\frac{1}{2}$ in. above rail level, I venture to think that the arrangement described is the best.

Thanking Mr. Simkins for his expression of appreciation with the external appearance of the engine, and trusting he will let us have a more explicit description of the gearing of his own engine, I am, yours truly,

HENRY GREENLY.

London, E.C.

To the Editor of *The Model Engineer*.

Dear Sir,—With reference to Mr. Simkins' letter in September 10th issue, I should like to say a word or two on the subject. The whole question of whether a worm or other gearing should be employed is settled after the consideration of one or two simple points. When a great reduction of speed is required from motor to driving wheel, a worm and wheel gear is employed in preference to a necessarily large wheel and small pinion, or a train of wheels; this being the case, the turning or rotating force on the worm will be practically nothing compared to the thrust on the worm, and consequently the armature spindle, when the driving wheels tend to revolve. Hence it is not possible, and one cannot expect to be able to push any model so fitted along, under these conditions. When the available power is ample and a tolerably large motor is employed, the speed ratio may be reduced accordingly, but until the latter is cut down very considerably indeed, it will not be practicable to turn the armature *from* the driving wheels.

I can only conclude that Mr. Simkins' model must aveh been geared fairly high to allow him to drive the armature from the driver as he describes. The fact of his model refusing to start, and that no slipping occurs, seems to show that there is lack of tractive power, for a weight of 12 lbs. is little, indeed.

Yours truly, W. C. RUNICMAN.

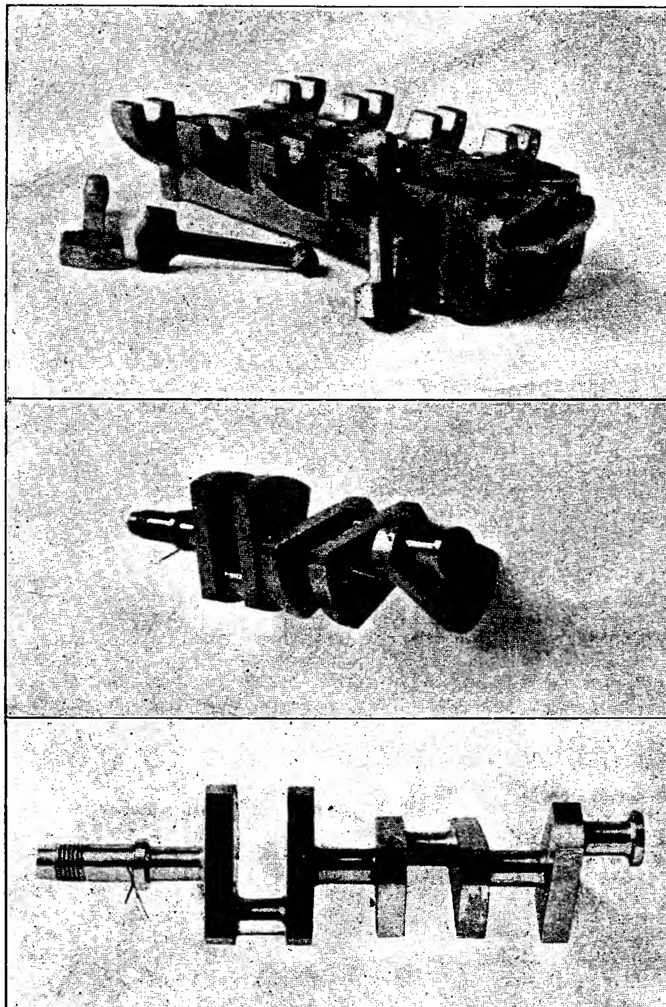
Crank-Shaft and Bedplate for Model Destroyer Engines.

To the Editor of *The Model Engineer*.

Dear Sir,—I am enclosing some photographs of some work I have in hand for the benefit of those readers who are interested in model destroyer making.

One is the aluminium bed for a 3-cylinder compound engine for a destroyer. This engine is to have three shafts, all three cylinders driving the central one. The port and starboard shafts are geared to run at the same speed, and have cams on them to operate the valves, which are of the mushroom pattern.

The pumps—bilge, air and feed—are driven from a rocking lever, worked by a wheel and pinion from



The Engines for Mr. V. B. Harley Mason's Proposed Model Boat Destroyer.
(*a*) Casting for bedplate and rods; (*b*) Crank-shaft, viewed from one end; (*c*) Side view of crank-shaft.

port shaft, the design being similar to that of the model cruiser *Tigress*.

The central crankshaft was too complicated to be forged so I proceeded by cutting it from a piece of 1¾ in. round steel bar, the stroke being 1 in.

The photos were kindly taken for me by Mr. Hingston, of model steam turbine fame.—Yours very truly, V. B. Harley-Mason.

Herne Hill, S.E.

Model Locomotive Design.

To the Editor of *The Model Engineer*.

Dear Sir,—Before replying to Messrs. Stuart Turner's and Greenly's letters in your recent issue, I should first of all like to correct a little misapprehension under whch the latter labours, viz., that Mr. H. E. Morriss was the inventor of the baffle-plates, and that he, Mr. Morriss, originally advised me to adopt that system. As regards the invention, I know nothing; but the fact that the baffle-plates were the outcome of No. 3's original boiler's failure through priming, and that they were fitted to the boiler before I had ever had the pleasure of making either Mr. Morriss' or Mr. Greenly's acquaintance.

With reference to Mr. Stuart Turner's interesting test, I am afraid he must consider me a very poor amateur if he imagines that I allowed such an elementary experiment to have escaped my notice. The test is one which, I believe, is universally carried out by most amateur model engineers, and it was only a few days ago that Mr. D. J. Smith, in speaking to me about past experiences, discussed a similar trial (to Mr. Stuart Turner's) of a model marine boiler, which we carried out twelve years ago.

Mr. J. D. H. Bryant and myself carried out tests of the boiler in April last, and I have a photo of the boiler taken during the tests, which I shall be pleased to show Mr. Turner as a proof of this statement. During a test, steam was raised to 60 lbs. sq. in., the regulator then turned on full, and kept open for ten minutes; the steam pressure never falling below 35 lbs. per sq. in., besides which not a drop of water issued from the steam pipe. A sheet of tin was placed in front of the pipe to catch any drops of water and to show priming.

I am sorry that my practice of eliminating back-pressure as much as possible, by leaving my blast pipes full bore, does not meet with Mr. Stuart Turner's approval, but I think those who have seen my models at work will agree with me that those models do not appear to lack sufficient draught, or steam when working; although the water level in the boiler is kept constant by a force pump worked from the crankshaft.

I am also sorry that I have not a model with the same size coupled wheels, cylinders, boiler, etc., as Col. Harvey's tank locomotive, but I have a model with a boiler having the same heating surface, and, if it is of any interest to the Society, I shall be pleased, during the forthcoming session, to carry out any steam-raising test with the boiler made by Mr. Stuart Turner. I will handicap my boiler to the extent that I grant Mr. Stuart Turner permission to have his burner alight and placed beneath his boiler before I will attempt to raise steam.

In order to be perfectly fair and just to Mr. Greenly, I have lately carried the tests he proposes in his letter as follows:—In the first place I removed the baffle-plates from the dome and worked the boiler under similar conditions to those in previous trials. Upon opening the regulator, priming was very evident; the cylinders becoming filled with water, evidenced by the exhaust, and a marked decrease in the speed of the engines.

Next a Stirling steam-collector was made and fitted, but there was the same trouble with priming, which disappeared altogether as soon as the baffles were fitted. I have been unable to fit a safety valve to the top of the dome, but hope to carry out this experiment in the future, although I anticipate no priming.

With regard to Mr. Greenly's final suggestion, *i.e.*, bursting a boiler, I can only remark that I have not a boiler to spare, and that I do not spend my time in that class of experiment, having a little more respect for my person; but inasmuch as Mr. Greenly speaks with such refreshing confidence, no doubt, he has undertaken such an interesting test. If, then, he will be courteous enough to provide me with a card of admission, when he next tests a steam bomb, I shall esteem it a great favour, as I have ever been fascinated by novelties.

The same gentleman asks my objection to dry steam. I reply, None!—in fact, I am an advocate of dry steam. What are the baffle-plates for, if not to obtain dry steam? Mr. Soper is also a strong advocate of dry steam, but I certainly do not believe in placing a condenser in the smokebox of a model locomotive. I know it is fitted with marked success in the real locomotive's smokebox, but a superheater in a model is of no use unless placed in the flame.

If in Mr. Greenly's designs he obtains flame in the smokeboxes, one must admit that his boilers are of faulty design to waste such generating power. That is one point that causes me to admire Mr. Soper's practical boilers: because they are so designed as to absorb every possible unit of heat from the flame. I have witnessed his experiments with "smokebox superheaters," and noted the marked improvement in the speed of the model when the so-called superheater, composed of coils of 3-16ths in. pipe, was taken off.

Again, my reasons for not advocating superheaters in gunmetal and cotton-packed cylinders, is the result of witnessing experiments carried out by Mr. H. E. Morriss in a model T.B.D. This model was worked with superheated steam, and, strange to say, after working a short period, the packing round the piston became charred, the glands very leaky, and the valves scored. I prefer to prolong the life of my models with less destructive energy.

Since the publication of Mr. Greenly's letter, I have obtained the views of Mr. David J. Smith, probably the greatest superheated steam expert in Great Britain, and Mr. H. E. Morriss, whose knowledge of high temperature steam in motor-car work is well-known.

The former gentleman stated that where cylinders with packed pistons or packed glands are used, filtered steam is undoubtedly the best, and that the smokebox of a model does not contain sufficient heat to superheat with efficiency.

Mr. Morriss says that you cannot use superheated steam with safety, unless iron cylinders and piston rings are used; and that, where superheating is resorted to, the superheater should be placed in the firebox.

Therefore, with due respect to Mr. Stuart Turner's

twenty-two years' experience, I am quite content to follow such expert advice as that of Messrs. Smith, Morriss, and Soper, whose combined experience of superheated steam amounts to forty-five years.

With regard to the remarks concerning the non-appearance of the 4-cylinder compound loco, on the S.M.E.'s track, it is due to the following reasons:—

(1) The engine has no tender: an old tender being fitted to carry out experiments.

(2) The track upon which I carry out my tests has been demolished.

(3) My rule never to exhibit a model under steam until I have thoroughly tested it.

(4) That I wish to fit new cylinders in order to experiment with a new type of balanced valve.

(5) To experiment with pumps until I obtain a regular water-level in the boiler.

(6) To fit an improved method of firing.

(7) And, in consequence of being without a track, I have carried out other work which, I think, will shortly convince the Society that my time has not been wasted.

As regards using superheated steam in this model, such a thought has never occurred to me, because the exhaust steam is so dry that I am even astonished.

I carried out experiments before Drs. Hobday and Grimsdale, and Mr. Bowling with that model, and all remarked upon the absence of water from the exhaust; in fact, I consider it now unnecessary to fit blow-off cocks.

Queries and Replies.

[Attention is especially directed to the first condition given below, and no notice will be taken of Queries not complying with the directions therein stated. Letters containing Queries must be marked on the top left-hand corner of the envelope "Query Department." No other matters but those relating to the Queries should be enclosed in the same envelope.

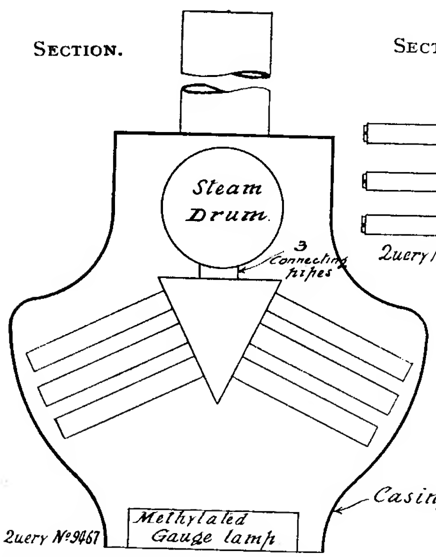
Queries on subjects within the scope of this journal are replied to by post under the following conditions:—(1) Queries dealing with distinct subjects should be written on different slips, on one side of the paper only, and the sender's name MUST *be inscribed on the back. (2) Queries should be accompanied, wherever possible, with fully dimensioned sketches, and correspondents are recommended to keep a copy of their Queries for reference. (3) A stamped addressed envelope (not post-card) should invariably be enclosed. (4) Queries will be answered as early as possible after receipt, but an interval of a few days must usually elapse before the Reply can be forwarded. (5) Correspondents who require an answer inserted in this column should understand that some weeks must elapse before the Reply can be published. The insertion of Replies in this column cannot be guaranteed. (6) All Queries should be addressed to The Editor,* THE MODEL ENGINEER, *35 to 39, Temple House, Tallis Street, London, E.C.]*

The following are selected from the Queries which have been replied to recently:—

[9467] **Model Water-Tube Boiler.** H. G. (Penarth) writes: Enclosed is a rough sketch of a model boiler, which was given in the *Engineer*. Could you give me the proper dimensions for one to drive a boat with an engine ½-in. bore by 1-in. stroke, and would it be suitable, and how best fired? A is a casting in gunmetal with flange for removable top. The pipes are intended to be screwed in and have closed ends. Will these give a proper circulation?

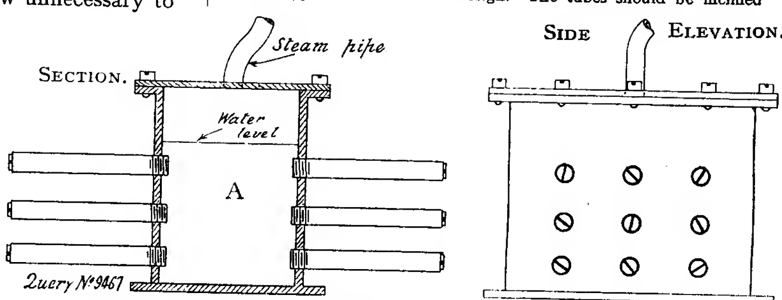
In reply to your query, we have a preference for a boiler in which water tubes give a much more direct circulation, and, therefore, we suggest an alternative design. The tubes should be inclined

SECTION.

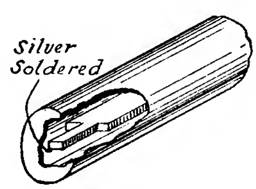


AMENDED DESIGN WITH INCLINED CIRCULATING OR "FIELD" TUBES.

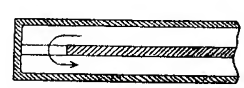
SECTION. SIDE ELEVATION.



PROPOSED MODEL WATER TUBE BOILER WITH CLOSED TUBES.



CIRCULATING TUBES SHOWING DIAPHRAGM.



SECTION OF CIRCULATING TUBES.

In conclusion, I should like to say that there are many amateur model engineers who have done a great deal of work towards the improvement of the model locomotive, and whose practical knowledge is of greater value to others than theories based on actual locomotive practice, which are not invariably applicable to their smaller companions.—Yours faithfully,

JAMES C. CREBBIN.

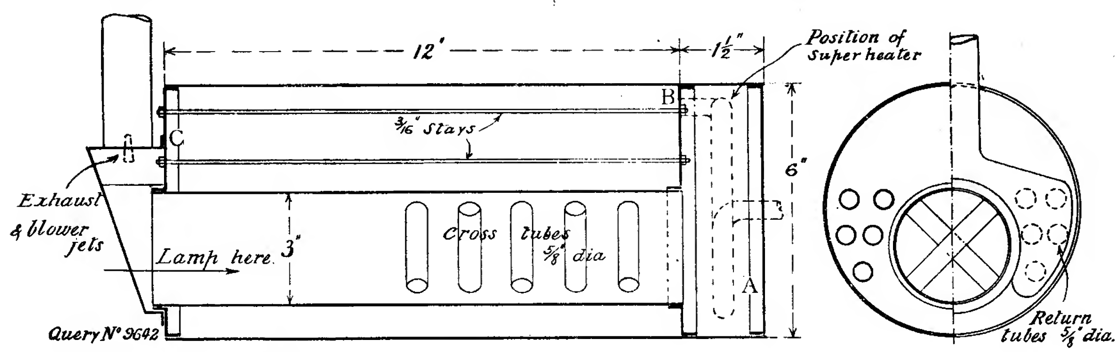
[We cannot trace in our pages the statement by our contributor as to the inventor of the baffle-plates for domes above referred to.—ED. *M. E. & E.*]

in this design, and provided with inner tubes as in "field" tubes or, as we suggest in the sketch, a diaphragm placed horizontally in the middle of the tube; to prevent this diaphragm being displaced and blocking up the clear passage from the top to the underside, the diaphragm should not be completely filed away, but a narrow projection left remaining, which will keep it clear from the end of the tube. The circulation will, with this arrangement, be very direct, and will be up the underside and down the topside of the diaphragm. By this means dry tubes, which are likely in your arrangement, will be prevented, and the boiler will not be noisy and much less erratic in steaming qualities. A spirit lamp may be used, or a vaporizing spirit burner of the jet type, as illustrated in our issue of November 15th, 1901, in a letter by Mr. C. H. Thomson.

[9642] **Model Marine Boiler for Steam Turbine.** G. R. B. (Clapton) writes: I am thinking of making a model boiler to the enclosed design. I think you will find that it has about 390 sq. ins.

of heating surface. (1) Would this give enough steam for two turbines, similar in size and design to Mr. Hingston's prize design? (2) Steam is to be superheated. I propose bringing the steam pipe from the boiler, and coiling it in the combustion chamber. Would this be an efficient method? (3) If the design of boiler is suitable, can you give me the thickness of plates A, B, and C, which are to be castings? (4) If design is not suitable, can you send me a sketch of a suitable boiler with outside dimensions, *not* greater than those I give you?

(1) We are inclined to think that you will find a single turbine of slightly larger dimensions much better than two smaller ones. The amount of steam a small turbine will consume is a matter for experiment; we have no practical data at present. (2) The steam should be superheated to a high degree as possible, as all small engines are very inefficient when considered as heat engines. The smaller the engine, the greater the losses by radiation and cylinder



Model Marine Return Tube Boiler with Dry Back.

condensation. This prevents, to a large extent, "linking up" in reciprocating model engines provided with reversing gear. (3) The design of the boiler is a very good one; of course, induced draught will be required, and if any pressure is evident on the exhaust side of the turbine wheel, a jet of exhaust steam may be used to urge the fire. The orifice should, however, be large. A blower, however, is essential—the jet should emerge from a pipe with an orifice of about 1-20th to 1-25th of an inch, and should be placed low down in the uptake. The plates A, B, C, may be respectively 1-16th in. and 5-64ths in. copper plate; dry back plate A may be of iron, with a flange formed of angle brass riveted on. The dry back should be removable. If boiler ends are castings, the plates will have to be at least 3-32nds in. or 7-64ths in. thickness when finished. We should not make dry back plate a casting in any case, unless weight does not matter. The superheater should be of the coiled pattern, in a volute, and not in a cylindrical coil. Use ¼ in. or 5-16ths in. pipe. Excessive radiation through the back plate may be prevented by an inside lining of asbestos millboard. The top stay should be lower down, three being used altogether.

[9481] **Charging Accumulators from Mains.** A. S. (Worksop) writes: I would be very much obliged if you will answer the following question. I have seen a 4-volt accumulator put on 240-volt main in series with a 32-c.-p. lamp for resistance, and have been told that it was not the voltage that mattered, but the amperage that wanted cutting down. Please let me know how it was figured out. I have got all your handbooks, but cannot see anything in any of them to answer this question. It has been connected up with 35-40 flexible wire.

A 32 c.-p. lamp on a 240-volt circuit takes about 2 amps., and as

$$C = \frac{E}{R} \qquad R = \frac{E}{C}$$

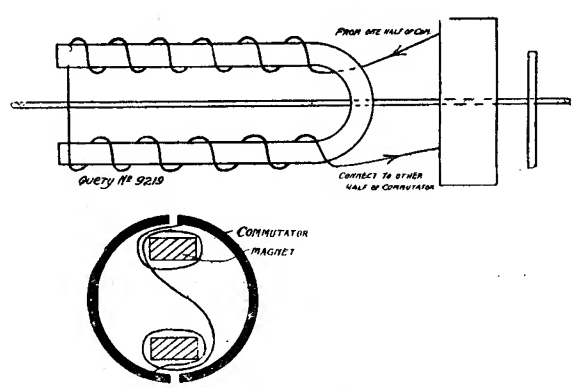
$$R = \frac{240}{2} = 120$$

Thus, the resistance necessary to allow a flow of 2 amps. on a 240 volt circuit is 120 ohms. By this you can find out exactly how much current is flowing into your accumulator and, as that is the vital point in charging accumulators of all kinds, it is not necessary to bother about the voltage, for the resistance of accumulators and connections, and other details often vary, and hence, although you may know what voltage the cell is being subjected to, you cannot always deduce from that the actual current which is being given to the cell. Therefore, we think it better in every case to use an ammeter to denote the current in preference to a voltmeter to show the voltage. Of course, if both instruments are handy, so much the better—use both—but, if not, look after the ampères, and all will be well.

[9498] **Jointing Rubber.** G. H. C. W. (Beddgelert) writes: Could you inform me how to make good joints with rubber similar to that used for motor car air chambers? I have tried in the usual way with solution, but I find that the joint is never solid and can easily be removed by benzine; while the joints made by the manufacturers, although apparently done with solution, are a fixture, and can hardly be removed by any means I know of. Is there any special treatment of the surfaces beyond cleaning and coating carefully with solution, or is the solution used by makers different in composition, or is heat, pressure, or vulcanising required? If the latter, can I vulcanise rubber? I have often had occasion to try and repair rubber goods, and have always found rubber a most impossible material. Could you in your valuable little paper give us any hints on working rubber, or is it entirely beyond your resources?

The factory-made joints in air tubes are made with solution, but it is a special strong kind in which the solvent is bi-sulphide of carbon. Pressure at a gentle heat is also employed, and ample time under pressure allowed. Much also depends on the careful preparation of the surfaces to be joined. In the case of an air tube, one end is turned over or "inside out" for some 3 ins., and this surface, together with the corresponding surface on the other end, is made perfectly clean by one or other of various methods of combination. You might try brimstone, followed by a thorough rub down with petrol or mineral naptha, until the clean black rubber is seen, then apply the solution thickly, allow this first coating to become practically dry, then revive with a thin coating, and when this is in the advanced tacky stage bring the ends together, turning back the overturned portion, and, if necessary, add a trifle more solution at the edge, then place under a weight for a few hours.

[9219] **Winding of Double Magnet Electro-Motor.** E. T. (Leamington) writes: In the article "The Amateur Electrician, What shall he Make?" p. 368, June 11th, 1903, Mr. E. H. Rooke describes the making of a double magnet motor. Will you please



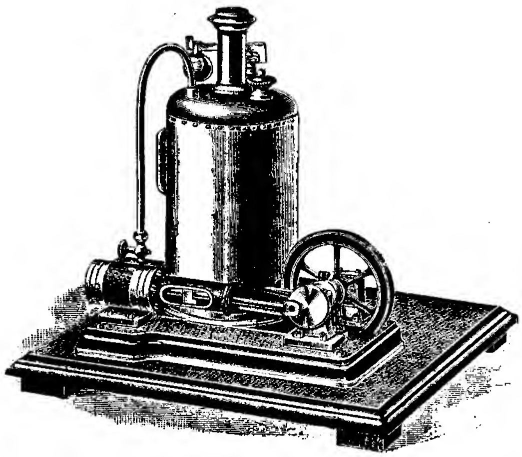
Winding a Double Magnet Electro-Motor.

inform me if two small ordinary magnets may be used? also, in Fig. 14, the wire connections are marked by dotted lines, but I cannot quite trace the wire leading from the fixed magnet round the boxwood holding the brushes.

(1) No. Soft iron is much better than steel, which small magnets are made from. (2) The wire is wound (as shown above) on the rotating magnet or armature.

[9151] **Four-Ball Transmitter.** G. K. F. (Chelmsford) writes: With regard to the four-ball transmitter for wireless telegraphy—(1) Do the two large balls discharge themselves through the vaseline or are they thoroughly insulated? (2) How far apart ought they to be? Does it depend on length of spark coil gives; if so, mine gives 6 ins.? (3) If two large balls are short circuited, will it act as a three-ball transmitter? (4) In the Lodge-Muirhead type of coherer, could the disc be iron instead of steel, or would it amalgamate? (5) Taking disc to be 3 ins. diameter, how long ought it to take to make one revolution? (6) Would it be best to mount mechanism and coherer separately on different bases or together on one baseboard, or would vibration be too great for mercury?

(1) Yes; the two large balls discharge themselves through the vaseline oil. (2) The distance between the balls is very small, a



Model Horizontal Engine and Boiler by the Clyde Model Dockyard.

very high voltage being necessary to pierce the oil. It may be from ½ to 1-16th, probably the lower figure—try. Your coil should work it perfectly. (3) Yes, the instrument would act, roughly speaking, as a three-ball oscillator if you short-circuited the two large balls, but the four sparking surfaces would have to be polished very brightly. (4) The disc could probably be iron, but should be accurately turned and polished. Steel it more durable and less likely to dent, etc. (5) We cannot give much definite information as to speed of rotation. It is fairly low, perpaps less than one rev. per second. We cannot definitely say—experiment (6) It depends on the mechanism. Very good clock-work would probably be all right, especially if mounted on rubber or felt. *Note.*—Vaseline oil oscillators or any others where oil is used, have great disadvantages, and are now practically disused.

The News of the Trade.

[*The Editor will be pleased to receive for review under the heading, samples and particulars of new tools, apparatus and materials for amateur use. It must be understood tha these reviews are free expressions of Editorial opinion, no payment of any kind being required or accepted. The Editor reserves the right to criticise or commend according to the merits of the goods submitted, or to abstain from inserting a review in any case where the goods are not of sufficient interest to his readers.*]

* *Reviews distinguished by the asterisk have been based on actual Editorial inspection of the goods noticed.*

*Model Horizontal Engine Castings.

The Clyde Model Dockyard, Argyll Arcade, Glasgow, have recently brought out a new set of castings for a model horizontal engine, as depicted in the accompanying illustration. The castings are sent out with very good fully-dimensioned working drawings, and the samples we have received show the set to be of very fair value. The price of the castings, with drawings, is 9s., carriage paid. The boiler to work this engine is fitted with three cross-tubes, glass water-gauge, steam-pressure gauge, etc.

Change of Address.

Mr. Ernest Pouteau, late of Warden Road, N.W., the well-known book dealer, informs us that he has removed his business premises to 231A, Gray's Inn Road, London, W.C., where all communications should now be addressed.

A Competition for Boys with Mechanical Tastes.

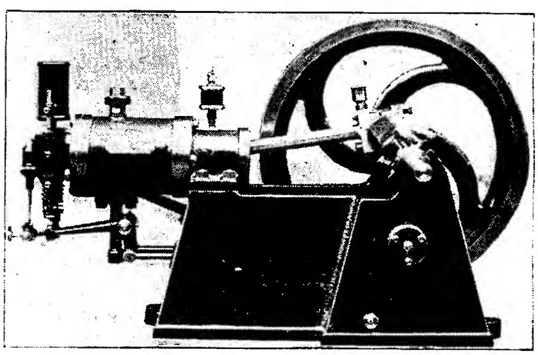
Some time ago we reviewed in this column what may be termed a "box of bricks," under the title of "Mechanics Made Easy" for embryo engineers, consisting of metal strips, angle-pieces, rods, cranks, wheels, bolts, and nuts, gear-wheels and keys, the possession of which enables the child with mechanical inclinations to build up model girder bridges, cranes, wheelbarrows, wagons, and towers. Messrs. Elliot & Hornby, of 18, James St., Liverpool, who supply these instructive toys, now announce a prize competition for boys under 15 years of age, in which five prizes, ranging from £5 to 10s., will be awarded to those who make up the best models from the parts in a box or boxes of "Mechanics Made Easy." Cardboard or other additions to make the model more attractive, will be allowed, and all models must be packed in cases and forwarded carriage paid to 18, James Street, Liverpool. Names must be sent in on or before January 10th, 1904, as the Exhibition will be held at the end of that month.

New Small Power Oil Engines.

The oil motor being a popular prime mover where gas is not available, Messrs. Geo. Goodman & Co., of East Hayes, Bath, have just brought out an engine of the horizontal type in three sizes—½ and ⅓ b.h.-p. and 2-man power. The accompanying photograph is from one of the largest of the engines. We have no further details of the construction, but it will be seen that the engine is fitted with an inertia governor; and Messrs. Goodman & Co., will, no doubt, be pleased to send full particulars of the engine to intending purchasers. Large photographs are being supplied for 1½d. post free.

*The "Noble" Cycle Motor.

The Noble Motor Company, Pocock Street, Blackfriars Road, who have sent us a sample finished engine for inspection, are now supplying castings for an up-to-date 2½ h.-p. petrol cycle motor. The engine seems to be very well designed, and has one cam actuating both the inlet and exhaust valves. The cylinder is 2¾-in. bore by 3-in. stroke, and the castings for this part, more especially, appear to be in every way excellent The complete set of castings (the crank chamber, &c., being of aluminium), together with workmanlike blue-print drawings, are listed at £2, and we can recommend the set to our readers as one of very good value.



Messrs. Geo. Goodman & Co.'s New ½ b.h.-p. Oil Engine.

Model-Making Prizes at Glasgow.

At a meeting recently held in the Glasgow City Chambers, Bailie Bilsland (convener of museums and galleries), Mr. James Paton (superintendent of the same), and several members of Town Council, met representatives from the University and the large shipbuilding and engineering firms, to consider the best means of promoting the forthcoming Naval and Engineering Exhibition, to be held at the People's Palace, Glasgow. It was decided that owing to restricted space, special efforts should be made to bring out the best possible show of amateurs' and workmen's models in the competition section, instead of calling upon large firms for exhibits. Fifty pounds will be given in prizes, besides certificates of merit. Particulars may be obtained from Mr. Thomas Lugton, Curator, People's Palace, Glasgow.

New Catalogues and Lists.

J. Arthur Williams, 92, Hatton Garden, London, W.C.—Mr. Williams has just issued a new pamphlet and price list descriptive of the interesting metal, "Magnalium," to which we referred some months back. The list will be sent free to any reader who sends a stamp for postage; but if six stamps are sent, some sample pieces of the metal will be included.

The Editor's Page.

ALTHOUGH the entries received for our Model Steamer Speed Competition have not been quite as numerous as we should have liked, some excellent performances are included, and the results generally show a marked improvement over the entries in our previous competition of this kind. As the time of going to press with this issue practically coincides with the closing of the competition, we are not yet in a position to give the names of the successful competitors, but hope to do so in next week's issue. We have just received a proof impression of the special MODEL ENGINEER Medal from the makers, and we think those who are fortunate enough to secure one of these awards will be very pleased with the design.

* * *

From across the Atlantic comes the following little note of appreciation :—" I have been intensely interested in the series of papers appearing in your journal by Mr. Chas. W. Cook, on 'Milling in Small Lathes,' that article alone being—to me, at least—well worth a year's subscription. I have had both the 'milling' and drilling attachments described by Mr. Cook made for me by one of our best tool-makers in New York, and, although varying somewhat in detail and arrangement from those described by him, they have proved a complete success and more than doubled the variety of work possible on my lathe. I am much in hopes that in a later paper in this series Mr. Cook will describe the method, in detail, of machining large flat and 'stepped' surfaces, such as the bedplates of model engines, &c., referred to by him in the opening paper of the series.—J. Y. W. (New York)."

* * *

With further reference to the high-speed engine recently described by Mr. Ricardo in our paper, the Liverpool Castings and Tool Supply Company write to say that they do not propose to supply castings for this engine, as there does not appear to be a sufficient demand to justify the trouble and expense of so doing. They state that they merely made the castings for Mr. Ricardo in the ordinary way of business, and have had nothing to do with either the burner or the boiler.

Answers to Correspondents.

C. H. P. (High Barnet).—Thanks for your note. You will be interested to know that we have another coloured plate in preparation for the first number of our next volume. The cost of these, unfortunately, precludes their more frequent distribution.

T. P. (Old Trafford).—Thanks for your very kind remarks. We are glad to know that our efforts to maintain the quality of the *M.E.* are so fully appreciated.

E. W. J. (Hereford).—Thanks for your appreciative letter. We are pleased to know you find the electrical articles so interesting.

C.N.S. (Wembley).—Vulcanite plates are not to be recommended. You might get some results from this, however, and we advise you to try and see what happens.

E. W. (Kelvinside).—We think your query has already been replied to ; but let us know if you have not received an answer.

C. A. P. (Lloyd Square).—We can recommend Professor A. Jamieson, of Glasgow.

Notices.

The Editor invites correspondence and original contributions on all amateur mechanical and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. It should be distinctly stated, when sending contributions, whether remuneration is expecced or not, and all MSS. should be accompanied by a stamped addressed envelope for return in the event of rejection. Readers desiring to see the Editor personally can only do so by making an appointment in advance.

This journal will be sent post free to any address for 13s. per annum, payable in advance. Remittances should be made by Postal Order.

Advertisement rates may be had on application to the Advertisement Manager.

HOW TO ADDRESS LETTERS.

All correspondence relating to the literary portion of the paper, and all new apparatus and price lists, &c., for review, to be addressed to THE EDITOR, "The Model Engineer," 35 to 39, Temple House, Tallis Street, London, E.C.

All correspondence relating to advertisements and deposits to be addressed to THE ADVERTISEMENT MANAGER, "The Model Engineer," 35 to 39, Temple House, Tallis Street, London, E.C.

All subscriptions and correspondence relating to sales of the paper and books to be addressed to the Publishers, Dawbarn & Ward, Limited, 6, Farringdon Avenue, London, E.C.

Sole Agents for United States, Canada, and Mexico: Spon and Chamberlain, 123, Liberty Street, New York, U.S.A., to whom all subscriptions from these countries should be addressed.

Contents.

[*The asterisk* (*) *denotes that this subject is illustrated.*]

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